

AD-A068 704

GAI CONSULTANTS INC MONROEVILLE PA

F/G 13/2

NATIONAL DAM INSPECTION PROGRAM. LAKE ONEIDA DAM, NDI NUMBER PA--ETC(U)

DACW31-78-C-0052

NL

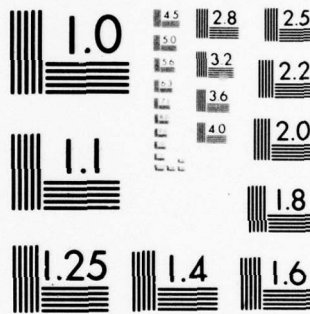
UNCLASSIFIED

1 OF 1

AD
A068 704



END
DATE
FILMED
6-79
DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD A068704

DDC FILE COPY

OHIO RIVER BASIN
CONNOQUESNESSING CREEK, BUTLER COUNTY
PENNSYLVANIA

LAKE ONEIDA DAM
NDI No. PA - 272



PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM .

Lake Oneida Dam, NDI Number PA-272.
Ohio River Basin, Connoquesnessing Creek,
Butler County, Pennsylvania. Phase I Inspector
Report.



Distribution Unlimited
Approved for Public Release
Contract No. DACW31-78-C-0052

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

SEPTEMBER 1978

ORIGINAL CONTAINS COLOR PLATES. ALL DDC
REPRODUCTIONS WILL BE IN BLACK AND WHITE.

79 05

14 170

139

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DDC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

PHASE I REPORT
National Dam Inspection Program

Lake Oneida Dam

Pennsylvania

Butler County

Connoquenessing Creek

30 August 1978 (visual inspection)

Inspection Team - GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

The visual inspection, records of past performance, and hydraulic and hydrologic analysis indicate that the facility is in need of remedial repair and further engineering evaluation. The facility on the whole is considered in fair condition.

Hydraulic and hydrologic calculations indicate that the project is not capable of passing and/or storing 50 percent of the flow resulting from a storm of the PMF magnitude and the spillway is deemed seriously inadequate.

Portions of the concrete paving in the spillway outlet channel have become dislodged exposing erodable materials within 50 feet of the embankment toe. The owners representatives reported that parts of the spillway have required repair and replacement at various times in the past following large spillway discharges.

Saturated conditions were observed in a few locations along the toe of the embankment. Seepage flow could not be measured; however, the condition warrants further investigation.

The gates on the inlet end of the supply line, passing beneath the embankment, are left open and discharge is controlled at the treatment facility. In addition, the blow-off line has reportedly not been operated in years. According to representatives of the water company, no regular maintenance is performed on the outlet controls, and their operability was not determined at the time of inspection.

Based on the above mentioned considerations, it is recommended that the owner:

1. Enlist the services of a registered professional engineer experienced in the design and construction of earth dams to:

i. More accurately assess the adequacy of the outlet works and make any modifications deemed necessary to insure that the facility is hydraulically adequate under PMF conditions. This investigation should also include an analysis of the effects of the Boydstown Dam facility located just upstream.

ii. Investigate and determine the cause of the seepage observed at the downstream toe of the embankment, the piping potential, and to recommend remedial measures if necessary.

iii. Inspect the facility on an annual basis and report on hazardous conditions that might develop. Results of these inspections should be transmitted to the Pennsylvania Department of Environmental Resources, Division of Dams and Encroachments, for review.

2. Immediately take measures to repair and/or replace the deteriorated portions of the spillway outlet channel and eroded area adjacent to the spillway outlet channel just downstream of the dam and make any modifications necessary to preclude the possibility of the spillway slabs becoming dislodged in the future.

3. Develop an operations and maintenance manual for the facility.

4. Ascertain the operability of the valve controls on both the supply and blow-off lines and maintain the systems in working order.

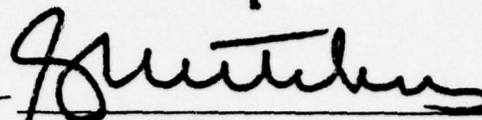
5. Revise the water company plan for maintaining a safe potable water supply to include provisions for warning downstream residents should emergency conditions develop. The plan should include provisions for round-the-clock surveillance of the facility during periods of high pool levels.

ACCESSION	
NTIS	Section <input checked="" type="checkbox"/>
DDC	Section <input type="checkbox"/>
UNANNOUNCED	<input type="checkbox"/>
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
Dist. Avail. and/or SPECIAL	
A	23 P

GAI Consultants, Inc.

Approved by:

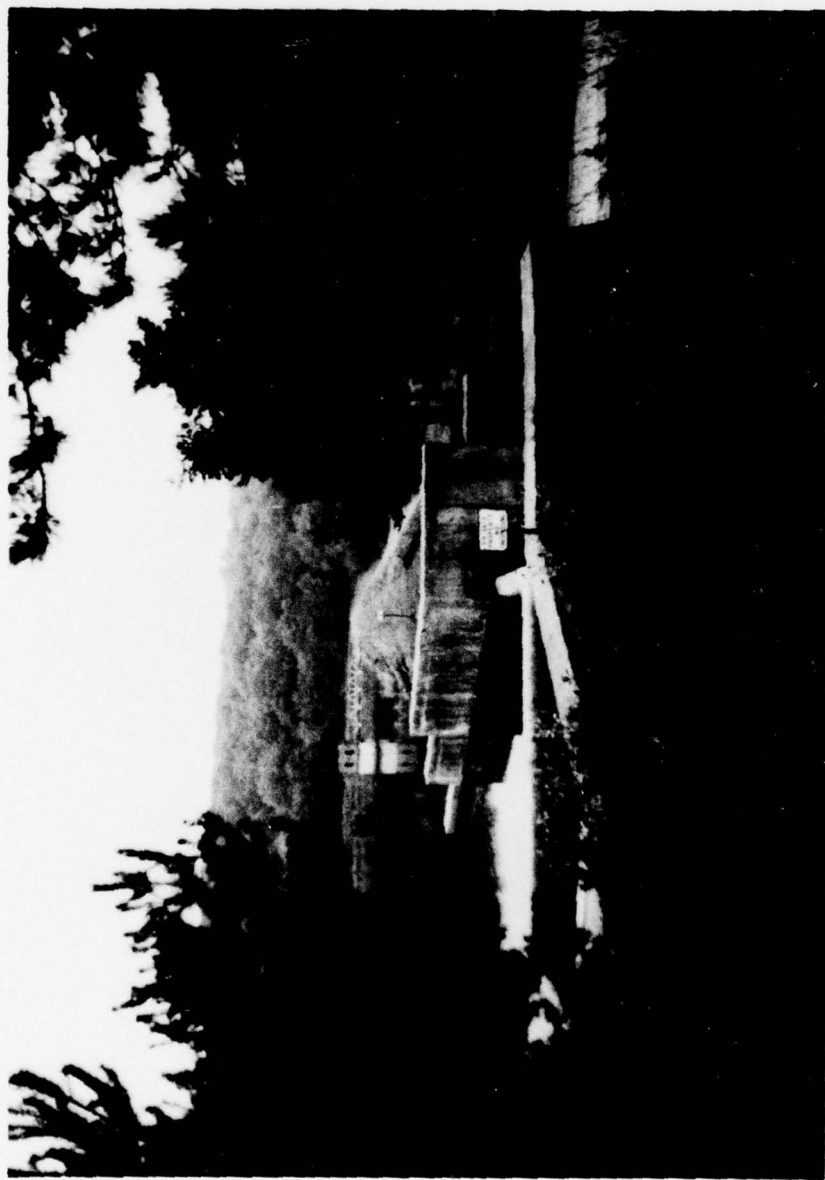

Bernard M. Mihalcin, P.E.


G. K. WITHERS
Colonel, Corps of Engineers
District Engineer



Date 27 Sept 78

Date 28 Sep 78



OVERVIEW PHOTOGRAPH OF ONEIDA DAM

TABLE OF CONTENTS

	<u>Page</u>
SYNOPSIS	i
OVERVIEW PHOTOGRAPH.	iv
TABLE OF CONTENTS.	v
SECTION 1 - GENERAL INFORMATION.	1
1.0 Authority.	1
1.1 Purpose.	1
1.2 Description of Project	1
1.3 Pertinent Data	2
SECTION 2 - ENGINEERING DATA	5
2.1 Design	5
2.2 Construction Records	6
2.3 Operational Records.	6
2.4 Other Investigations	6
2.5 Evaluation	6
SECTION 3 - VISUAL INSPECTION	8
3.1 Observations	8
3.2 Evaluation	10
SECTION 4 - OPERATIONAL PROCEDURES	11
4.1 Normal Operating Procedure	11
4.2 Maintenance of Dam	11
4.3 Maintenance of Operating Facilities.	11
4.4 Warning Systems in Effect.	11
4.5 Evaluation	11
SECTION 5 - HYDROLOGIC/HYDRAULIC EVALUATION.	12
5.1 Design Data.	12
5.2 Experience Data.	12
5.3 Visual Observations.	13
5.4 Overtopping Potential.	13
5.5 Spillway Adequacy.	14
SECTION 6 - EVALUATION OF STRUCTURAL INTEGRITY	15
6.1 Visual Observations.	15
6.2 Design and Construction Techniques	15
6.3 Past Performance	16
6.4 Seismic Stability.	16
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES.	17
7.1 Dam Assessment	17
7.2 Recommendations/Remedial Measures.	18

TABLE OF CONTENTS

APPENDIX A - CHECK LIST - ENGINEERING DATA
APPENDIX B - CHECK LIST - VISUAL INSPECTION
APPENDIX C - HYDRAULICS AND HYDROLOGY CALCULATIONS
APPENDIX D - PHOTOGRAPHS
APPENDIX E - GEOLOGY
APPENDIX F - FIGURES
APPENDIX G - REGIONAL VICINITY MAP

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE ONEIDA DAM
NDI# PA-272, PENNDER# 10-11

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lake Oneida Dam is an earthfill embankment with a concrete corewall and a steel sheetpile cutoff. The overall length of the embankment is approximately 830 feet and its maximum height is approximately 38 feet. The facility is equipped with a concrete spillway at the right abutment and 30-inch diameter blow-off and supply lines encased in concrete beneath the embankment. The lines are gated in a control tower located within the upstream slope near the embankment center. Access to the gate house is provided by a foot bridge. ABSTRACT

b. Location. Lake Oneida Dam is located just downstream of Boydstown Reservoir along the Connoquenessing Creek in Oakland Township, Butler County, Pennsylvania, about 5-1/2 miles north of Butler, Pennsylvania. PA Route 38 is located adjacent to the north shore of the reservoir. Dam, reservoir, and watershed are contained within the East Butler and Mount Chestnut U.S.G.S. 7.5 minute quadrangles (see Appendix G). The coordinates of the dam are N40° 55.4' and W79° 52.8'. ABSTRACT

c. Size Classification. Intermediate (38 feet high, 3,350 acre-feet to the top of the dam).

d. Hazard Classification. High (see Section 3.1.c.4).

e. Ownership. Western Pennsylvania Water Company
Butler District
105 Lincoln Avenue
Butler, Pennsylvania 16001

f. Purpose of Dam. Water supply with limited recreational use permitted.

g. Historical Data. Records available in PennDER's files indicate that construction of the facility was initiated in 1910. After completing the sheetpile installation, construction was terminated due to lack of capital. Contract drawings and specifications were apparently resubmitted in 1916 for permit application by the Butler Water Company and the project was taken to completion by mid-1918. Design and construction of the facility was apparently performed by Butler Water Company personnel.

Monthly progress reports by the Water Supply Commission of Pennsylvania indicate only minor problems with winter construction and flooding.

1.3 Pertinent Data.

a. Drainage Area. 16.6 square miles.

b. Discharge at Dam Site. Discharge records compiled daily and records from the last 6 to 7 years are available at the Butler District Office. The maximum discharge (as per recollection of production superintendent) occurred in 1954 with a flow estimated at 58 inches over the spillway crest. (estimated flow \approx 4000 cfs).

Outlet Works Conduit - Discharge curves not available for blow-off and supply lines.

Spillway Capacity at Maximum Pool \approx 5000 cfs
(assuming spillway acts as broad-crested weir with length of 58.5 feet).

c. Elevation (feet above mean sea level).

Top of Dam \approx 1067.5.

Maximum Pool Design Surcharge - Not known.

Maximum Pool of Record \approx 1063.6.

Normal Pool (spillway crest) \approx 1058.8.

Upstream Portal Invert Outlet Conduit (blow-off) \approx 1028.6.

Downstream Portal Invert Outlet Conduit \approx 1028.3.

Streambed at Centerline of Dam \approx 1028 (estimated).

Maximum Tailwater - Not known.

d. Reservoir.

Length of Maximum Pool (1067.5) \approx 1.8 mile.

Length of Normal Pool (1058.8) \approx 1.7 mile.

e. Storage (acre-feet).

Spillway Crest \approx 1760.

Top of Dam \approx 3350.

Design Surcharge - Not known.

f. Reservoir Surface (acres).

Spillway Crest \approx 155

Top of Dam \approx 210

Design Surcharge - Not known.

g. Dam.

Type - Earthfill with concrete corewall and sheetpile cutoff.

Length - 830 feet.

Height - 38 feet.

Top Width - 13 feet.

Side Slopes - upstream: 2H:1V
downstream: 2H:1V

Zoning - Lake Oneida Dam is a homogeneous earth-fill dam with a thin reinforced concrete corewall and steel sheetpile cutoff. Drawings and correspondence indicate that the embankment contains four 18- x 18-inch lateral drains (blind drains filled with stone) that extend from the corewall to the downstream toe.

Cutoff - Contract documents indicate that interlocking steel sheetpile were driven from the base of the corewall trench to depths of about 20 feet (apparently into underlying "blue clay").

Grout Curtain - None.

h. Outlet Conduit.

Blow-off Line

Type - 30-inch steel blow-off line encased in concrete within embankment. At the downstream toe the line becomes a 30-inch CIP.

Length = 465 feet.

Closure = Sliding gate within intake tower.

Access - Foot bridge to gate house atop intake tower. Rung ladder to gate.

Supply Line

Type - 30-inch steel main encased in concrete within embankment. Reduced to 24-inch CIP near downstream toe.

Length - Approximately 140 feet to 24-inch reducer.

Closure - Gate valves within intake tower.

Access - Foot bridge to gate house. Rung ladders to valves.

Regulating Facilities - Outflow through supply line is controlled at the treatment plant. Blow-off sluice gate is closed. All other valves are kept open at the gate house.

i. Spillway.

Type - Concrete broad-crested weir projecting into reservoir resulting in side channel spillway effect at low heads (see Figure 4).

Crest Length - 129.5 feet at low flow (See Discussion 58.5 feet at high flow Section 5).

Channel Length - 360 feet.

Crest Elevation = 1058.8.

Upstream Channel - Riprap lined approach channel.

Downstream Channel - Trapezoidal channel cut into Natural soil below stilling basin which extends to old stream channel.

j. Regulating Outlets. Blow-off line and supply line with inlets located at gate house (see Section h, above).

SECTION 2 ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. No design calculations are available. Correspondence relative to spillway analysis and hydrologic requirements are available in PennDER files.

2. Embankment. No design calculations are available. Embankment and subsurface details are indicated on drawings available from PennDER and owner's files.

3. Appurtenant Structures. No design calculations are available. Structural details are shown on drawings available from PennDER and owner's files.

b. Design Features.

1. Embankment. Contract drawings, specifications, and inspection reports (all available in PennDER files) indicate the embankment is a rolled earthfill structure containing a reinforced concrete corewall underlain by interlocking steel sheetpiling. Contract drawings and the visual inspection indicate that the upstream and downstream faces are sloped at 2H:1V. Drawings and specifications indicate that four 18- x 18-inch stonefilled drainage laterals were constructed from the corewall to the downstream toe. Field inspection indicates that these drains may be directed into drain tile that discharges into the natural stream channel. Contract drawings indicate that the steel piling extends about 20 feet below the base of the corewall, probably penetrating the clay strata indicated by the geologic cross section. (See Figure 7).

2. Appurtenant Structures. The spillway is a modified concrete chute with a broad-crested weir section projecting into the reservoir (see Figure 4). Contract drawings indicate the weir section is underlain by a sheet-pile cutoff similar to the embankment. The spillway continues as a curved rectangular channel for about 150 feet from the crest where it discharges into a concrete-lined trapezoidal channel. This channel empties into a rock-lined stilling basin another 210 feet downstream.

The outlet works consists of a gate house, control tower, and two 30-inch diameter discharge lines (a blow-off and a supply line). The gate house and tower are located on the upstream slope near the embankment center and are

accessible from the embankment crest via a foot bridge. Both blow-off and supply lines are steel and encased in concrete beneath the embankment. Contract drawings indicate that they both connect to cast iron pipes outside the embankment toe. The blow-off line terminates at the old stream channel approximately 240 feet from the embankment toe.

c. Design Data and Procedures.

1. Hydrology and Hydraulics. No design calculations are available. A review conducted by the Water Supply Commission in 1916 indicated that the spillway should be sized for a peak flow of 4,730 cfs based on experience with similar watersheds. Later reports in 1936 and 1949 indicate a required spillway capacity of 8300 cfs and 16,300 cfs based on experience and revised criteria.

2. Embankment. No design data are available.

3. Appurtenant Structures. No design data are available.

2.2 Construction.

Contract drawings, specifications, and construction inspection reports are available in PennDER files. Specifications are detailed with respect to piling; reinforcing steel; concrete mixes, placement, forming, and finishing; soil placement; and selection.

2.3 Operational Records.

Daily rainfall (from nearby Thorn Run watershed) and discharge records are available for the last six to seven years at the Butler office, of Western Pennsylvania Water Company.

2.4 Other Investigations.

PennDER files indicate periodic inspections were performed through 1964. The owner has initiated yearly inspection since 1977 for insurance requirements.

2.5 Evaluation.

a. Availability. General engineering data in the form of contract drawings, specifications, and correspondence are available in PennDER files. No specific design calculations are available.

b. Adequacy of Data. Sufficient data are available to make an accurate general assessment of the facility.

SECTION 3 VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the structure and the related appurtenances suggests that the dam is in fair condition.

b. Embankment. The embankment is in general conformance with the lines and grades shown on the drawings supplied by PennDER. No signs of slope distress were noted at the time of inspection; however, a few areas of minor seepage were observed along the toe of the embankment. Seepage flow could not be measured although portions of the toe were saturated (see Figure 1 for location of seepage areas). All of the seepage areas were previously reported in various PennDER reports over the years. The consensus was that the seepage presented no threat to the integrity of the structure. It should be pointed out that a system of blind stone drains were provided at 170-foot intervals downstream of the corewall (see Figure 2). At the time of inspection, a clay tile drain was found discharging water into the old stream valley approximately 130 feet downstream of the dam toe. It is conceivable that this tile drain is connected to the blind drains; however, this is entirely conjecture since no mention of a tile drain is made on the drawings.

The downstream face and crest of Lake Oneida Dam are covered with grassy vegetation; whereas, the upstream slope is mantled with a 12-inch thick layer of durable sandstone riprap. Both the upstream and downstream faces are sloped at 2H:1V and the crest is approximately 13 feet wide.

c. Appurtenant Structures.

1. Gate House, Blow-off, and Supply Line. Lake Oneida Dam is provided with two 30-inch diameter steel pipes encased in concrete beneath the dam. Both lines change to cast iron construction just downstream of the dam. One of the pipes serves as a blow-off line which discharges into the original stream channel approximately 300 feet downstream of the centerline of the dam. The other, a 30-inch diameter line serves as the supply line to the water distribution system. This line reduces to 24 inches at a wye just downstream of the dam (see Figure 2).

The blow-off and supply lines are gated within a masonry gate house located near the center of the embankment. Discharge can be controlled via a system of gate valves and sluice gates at the operating floor of the gate house (see Figure 9). According to a water company representative, all the valves on the supply line are open and the flow is

regulated at the treatment plant. The blow-off line is reportedly opened very infrequently and it is not known if it is currently operable.

2. Spillway. The spillway at Lake Oneida Dam is a broad-crested weir which partially projects into the reservoir affording increased surface area for discharge at low pool levels (see Figure 4 and Photograph 2). Discharge is carried through a rectangular concrete channel to a point approximately 150 feet downstream of the spillway crest where flow enters a concrete-lined trapezoidal channel before entering a trapezoidal channel cut in earth (see Figure 2).

At a point just downstream of the rectangular concrete spillway chute (180 feet downstream of spillway crest), severe erosion has occurred which has resulted in the removal of the concrete paving in the spillway outlet channel (see Photographs 5, 6 and 7). As a result, there has been significant erosion of the alluvial materials just downstream of the dam and encroachment of an erosional scarp toward the toe of the dam. At the time of inspection, the edge of the erosional scarp was 50 feet from the dam.

According to water company personnel, several of the concrete slabs within the spillway outlet channel were removed in 1954 during high flow associated with hurricane "Hazel".

In general, the spillway is in good condition in the rectangular section of the outlet channel; however, the trapezoidal portion of the channel is in a state of disrepair and requires considerable remedial work (see Photographs 5, 6, and 7).

3. Reservoir Area. The slopes adjoining Lake Oneida Reservoir are generally moderate to steep and primarily wooded. No signs of slope distress were observed at the time of inspection.

4. Downstream Channel. The area immediately downstream of Lake Oneida Dam is characterized as a sparsely wooded floodplain (600 to 1,000 feet wide) containing the sluggish flowing waters of Connoquenessing Creek (gradient 10 to 15 feet/mile). More than 20 homes, with an estimated population of 60 to 80 people, are located on the floodplain within two miles of the dam. The city of Butler, Pennsylvania, is located approximately 5.5 miles downstream. Included within this 5.5 mile interval are primary and secondary road bridges as well as other improvements such as commercial establishments and rail yards. Because of the above mentioned considerations, the dam was placed in a "high" hazard category.

3.2 Evaluation.

Areas of seepage were located along the toe of the embankment requiring additional investigation. The concrete-lined trapezoidal portion of the spillway outlet channel is deteriorated and requires immediate attention. The condition or operability of the supply and blow-off lines is suspect since they have reportedly not been operated in years.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Normal Operational Procedure.

According to representatives of the water company, there are no formal operational procedures detailed in manual form. Rather, discharge to the supply system is regulated at the treatment facility located about four miles downstream of the dam. Excess inflow passes over the spillway and enters the Connoquenessing Creek drainage.

4.2 Maintenance of Dam.

There are no formal maintenance procedures at the dam. Grass is mowed and brush cleared on an as-needed basis.

4.3 Maintenance of Operating Facilities.

As best as could be determined, there is no maintenance of the operating facilities at the dam site. The valves are left full open at the reservoir and flow is regulated at the treatment plant.

4.4 Warning System.

There is no formal warning system in effect at the site; however, Western Pennsylvania Water Company has, an emergency plan for maintaining a potable water supply that can be readily adapted for this use.

4.5 Evaluation.

No formal operational procedures are available in written form from the owner. The embankment slopes are reportedly mowed on an as-needed basis; however, there is apparently no other regular maintenance program.

The inlet end of the supply pipe is opened at the dam and flow is regulated at the treatment facility located approximately four miles downstream. According to the owners representative, the blow-off line has not been operated in years and its operability is unknown.

A formal warning system to protect downstream residents should be established.

SECTION 5 HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No hydrologic or hydraulic design reports are available. An informative discussion of the weir design at Lake Oneida Dam is available from PennDER files in the form of a memorandum dated April 6, 1949. It was apparently written by a hydraulic engineer (name not legible) working for the Water Resources Commission (predecessor of PennDER). The report discusses the results of a crude model test (1/120 scale) performed on the weir at Lake Oneida Dam.

The results of the test indicated that at low flow the spillway behaved normally but exhibited severe contractions in the overflow section at both abutments and at the reentrant angles. These contractions along with crossing nappes at the interior angles of the weir caused a loss in efficiency although no estimate of the loss was possible. At high heads the above mentioned conditions persisted. The principal change occurring at high heads was that on the weir walls extending upstream the flow is no longer normal to the axis of the weirs but is tending to cross at an angle which approached parallel flow to the axis of the dam. This behavior indicated that at high heads the discharge approached that of a simple weir having a length equal to the channel opening.

The memorandum closed by recommending that a controlled model test be made of the spillway and spillway channel to determine their adequacy. The report noted that the owners claimed a capacity of 8,300 cfs for this design. It was believed that at maximum head, the actual discharge will be less than this figure. Furthermore, the design discharge of 8,300 cfs did not meet the Water Supply Commission requirement of 16,300 cfs supplied to the owner in 1946.

5.2 Experience Data.

Rainfall and reservoir pool levels reportedly are recorded daily and kept on file at the treatment plant located downstream. Apparently over the years the owners have had problems when discharge through the spillway has dislodged portions of the concrete paving on the apron and channel sidewalls. This problem is evidenced by the damage (mentioned in previous sections) currently visible in the spillway outlet channel.

5.3 Visual Observations.

It was obvious from the condition of the lower spillway on the date of inspection that the spillway channel will not function satisfactorily during a flood event. In fact, it would be expected that such an event would result in more extensive damage. No other conditions were observed that would indicate the remaining appurtenant structures could not function properly.

5.4 Overtopping Potential.

Three separate analyses were performed on the spillway at Lake Oneida Dam. First, the spillway discharge was calculated assuming 129.5 feet of weir (full weir length). Secondly, an effective weir length of 58.5 feet (width of the channel at the weir) was used. The third case involved calculating the capability of the facility to pass the PMF based on a spillway capacity of 8,300 cfs as per the memorandum April, 1949, discussed in Section 5.1.

The ratio "PMF Peak Flow/Drainage Area" was determined from an empirical curve supplied by the Corps of Engineers, Baltimore District. The curve used was the Ohio River Basin curve. Based on this curve and a drainage area of 16.6 square miles, Peak PMF $Q/A \approx 1290$ cfs/sq. mi., and Peak PMF $Q \approx 21,400$ cfs. The size category is "intermediate" and the hazard rating "high". Consequently, the SDF is the PMF.

Calculations were performed to evaluate the overtopping potential using spillway and storage capacities during the PMF (see Appendix C).

Based on weir lengths of 129.5 feet and 58.5 feet, the maximum spillway discharge was calculated to equal approximately 11,000 cfs and 5,000 cfs, respectively. Comparing discharge (11,000 cfs and 5,000 cfs) to maximum inflow (Peak PMF $Q \approx 21,400$ cfs) reveals the need for substantial storage volume. It was found for both cases that the storage required (11,000 acre-feet and 17,700 acre-feet) greatly exceeded the storage available (1,600 acre-feet). It was found that under conditions of the first case, approximately 59 percent of the PMF is discharged and/or stored; whereas, under conditions of the second case, approximately 30 percent of the PMF is discharged and/or stored.

The memorandum of April 6, 1949 (discussed in Section 5.1) suggests that the results of the second case are more probable than the results of the first case.

As a further check, a similar analysis was performed based on a spillway capacity of 8,300 cfs (claimed by the owner to be the maximum spillway capacity; see Section 5.1). In this the third case, the required reservoir storage (14,000 acre-feet) was also found to exceed the storage

available 1,600 acre-feet). It was ultimately found that under conditions of the third case approximately 46 percent of the PMF is passed and/or contained.

Finally, the effects of the upstream dam at Boydstown Reservoir, which is contained within the watershed for Lake Oneida Dam, were considered as part of the overall analysis of Lake Oneida Dam. Based on a drainage area of 13.6 square miles, Peak PMF $Q \approx 18,800$ cfs. The maximum spillway discharge was calculated to approximately equal 4,500 cfs. Once again, inflow (18,800 cfs) exceeds discharge (4,500 cfs). Thereby suggesting a need for substantial storage. The calculated storage required (14,300 acre-feet) is found to be much greater than the storage available (307 acre-feet). The end result is that the dam at Boydstown Reservoir will pass and/or contain approximately 26 percent of the flow resulting from the PMF. Consequently, this structure will have no retarding effects relative to the PMF inflow into the reservoir at Lake Oneida Dam and could, if it fails, contribute its normal pool storage (221 acre-feet) as additional inflow to Lake Oneida Reservoir during a PMF event.

In summary, the entire analysis suggests that Lake Oneida Dam is capable of passing and/or containing runoff resulting from a storm of magnitude between 30 and 59 percent of the PMF, neglecting the possible adverse effects of a failure of the upstream dam at Boydstown Reservoir and minor crest settlement or deviations. The maximum spillway discharge would more closely approximate the former percentage; consequently, this number will be used to assess the spillway adequacy.

5.5 Spillway Adequacy.

The facility at Lake Oneida Dam is capable of passing and/or containing a storm of approximately 30 percent of the PMF.

Since overtopping is expected to cause embankment failure and since numerous homes are located at various levels above the floodplain, overtopping would significantly increase the potential hazard to residents downstream from that which would exist just prior to failure. Consequently, the spillway is deemed seriously inadequate.

SECTION 6 EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Areas of minor seepage were observed at the toe of the embankment. A spring is located on the left abutment adjacent to the old Connoquenessing Creek channel. These items are well documented in PennDER files and flow emanating from these areas is considered insignificant. Contract drawings indicate that four blind stone drains were provided downstream of the concrete cutoff wall. The inspection team located a tile drain discharging into the old stream channel 130 feet downstream of the dam toe and it is conceivable that this drain pipe is connected to the stone drains, although no mention of the tile drain is made on available drawings.

b. Appurtenant Structures.

1. Spillway. The weir and rectangular concrete portion of the spillway outlet channel appeared in good condition. However, from the point where the outlet channel becomes a concrete trapezoidal channel (\approx 150 feet downstream of the weir) the structure is severely deteriorated and in need of repair (see Photographs 5, 6, and 7). Some of the concrete sidewall slabs have become dislodged exposing erodable materials within 50 feet of the toe of the dam (see Figure 1 and Photographs 5 and 6). If the condition is allowed to persist, it is possible that lateral encroachment by erosion could transgress to the point where it could eventually affect the stability of the embankment.

2. Outlet Works. According to representatives of the water company, the blow-off pipe has not been operated in years. The valves that control discharge through the 30-inch supply pipe are kept open at the gate house and flow is controlled at the treatment plant located about four miles downstream. Although this is a common mode of operation, it is desirable to have the ability to control flow at the inlet end of all piping systems passing through or beneath earthen embankments. The gate controls should therefore be kept in working order.

6.2 Design and Construction Techniques.

Actual design data, design computations, or reports were not available for any aspect of the facility.

6.3 Past Performance.

Reservoir level records are available at the owner's Butler office for the last six or seven years. The owners representative reported that during the rains associated with Hurricane Hazel in 1954 portions of the spillway slabs were dislodged and moved downstream. It is not known, however, if provisions have since been made to anchor the slabs and prevent a recurrence of the problem.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and it is thought that the static stability of the structure is sufficient to withstand minor earthquake induced dynamic forces; however, no calculations, investigations, etc., were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection, past performance, and available engineering data suggest that the dam is in fair condition, requires additional analysis and some immediate remedial repair.

Hydraulic and hydrologic calculations indicate that the facility is capable of discharging and/or storing approximately 30 percent of the PMF neglecting the possible adverse effects of a failure of the upstream dam at Boydstown Reservoir. The hazard rating for the facility is high and failure due to overtopping would significantly increase the hazard to downstream residents from that which would exist prior to overtopping. Therefore, the spillway is considered seriously inadequate.

Additional problems are encountered when one considers the adequacy of the outlet works at Boydstown Reservoir, located just upstream of Lake Oneida. Brief calculations show that the Boydstown spillway is also seriously inadequate since the facility is capable of passing and/or storing only 26 percent of the PMF. This suggests the possibility of Boydstown Reservoir Dam overtopping and failing prior to or concurrent with the overtopping of Lake Oneida Dam.

The spillway outlet channel in the concrete-lined trapezoidal section is severely deteriorated. Large portions of the concrete paving have been removed and erosion has progressed toward the toe of the dam. This condition should be remedied immediately..

Saturated conditions were observed at the toe of the dam in a few areas (see Figure 1). These areas of seepage have been noted in PennDER files since shortly after the embankment was constructed. Flow could not be measured; however, the condition warrants further investigation by a geotechnical engineering experienced in dam design.

The blowoff pipe has not been operated in years. The valves controlling discharge through the supply line are kept open at the dam and flow is regulated at the treatment facility. The condition or operability of the valve controls is not known.

b. Adequacy of Inspection. The available data was thought to be sufficient to make an accurate Phase I assessment of the facility.

c. Urgency. It is suggested that the recommendations listed below be implemented immediately.

d. Necessity for Additional Investigations. Additional investigations, as listed below, are considered necessary.

7.2 Recommendations/Remedial Measures.

a. Facilities. It is recommended that the owner:

1. Enlist the services of a professional engineer experienced in the design and construction of earth dams to:

i. Make a detailed hydraulic and hydrologic analysis in order to more accurately ascertain the adequacy of the outlet works and to insure that the facility is hydraulically adequate under PMF conditions. This investigation should include an analysis of the effects of the Dam at Boydstown Reservoir (also owned by Western Pennsylvania Water Company) located just upstream.

ii. To investigate and determine the cause of the seepage observed at the downstream toe of the embankment, its effect on the overall stability of the embankment, as well as the piping potential, and recommend remedial measures if necessary.

iii. Inspect the facility on an annual basis. The results of these inspections should be transmitted, in report form, to the PennDER, Division of Dams and Encroaching for their review.

2. Take measures to repair and/or replace the deteriorated portions of the spillway outlet channel and eroded area adjacent to the spillway channel just downstream of the dam and provide a means to ensure that the replaced concrete spillway slabs cannot be dislodged during future flood events.

b. Maintenance and Operating Procedures. It is recommended that the owner:

1. Develop an operations and maintenance manual for the facility.

2. Assess the operability of the valve controls for the supply and blow-off lines and maintain the controls in working order.

3. Revise their plan to maintain a safe potable water supply to include provisions for the warning of downstream residents should emergency conditions develop. The plan should include round-the-clock surveillance of the facility during periods of high water levels.

APPENDIX A

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

NAME OF DAM Lake Oneida Dam

DESIGN, CONSTRUCTION, OPERATION

ID # NDI# PA-272; PennDER# 10-11

PHASE I

ITEM	REMARKS	SHEET 1
------	---------	---------

AS-BUILT DRAWINGS

1. Ten drawings dated 1910 and approved by Water Supply Commission of PA in 1916 in PennDER files.
2. Topo Map (1909) of Little Connoquenessing Valley (scale 1" = 100') in PennDER files.
3. Eight miscellaneous drawings in PennDER files showing weir & spillway repairs and REGIONAL VICINITY MAP various proposals.
4. Two originals from owner showing 1968 spillway repairs.

Dam, reservoir, and watershed on East Butler, PA, 7.5 minute quadrangle map.
Construction Drawing No. 30036 in PennDER files.

CONSTRUCTION HISTORY

Permit, some correspondence, specifications, and inspection reports on microfiche in PennDER files.

TYPICAL SECTIONS OF DAM

Construction Drawing No. 30039 - Butler, PA, Lake Oneida Dam, Cross-sections.

OUTLETS - PLAN Construction Drawing 30036 - General Plan, Lake Oneida Dam.

Construction Drawing 30041 - Spillway and Weir; also plans and details for subsequent - DETAILS revisions.

Construction Drawing 30044 - Gate house.

- DISCHARGE RATINGS Untitled 8-1/2 x 11 graph with approximate discharge, depth of flow, and year measured.

RAINFALL/RESERVOIR RECORDS

Rainfall gage at nearby Thorn Run Reservoir - Read daily (6 to 7 years of records are available at Butler office of WPW Co.).
Reservoir level measured daily (records also at Butler office).

DESIGN REPORTS

None. A 12-page report dated 1916 which reviews the design drawings, specifications, etc., is available in PennDER files.

GEOLOGY REPORTS

None.

DESIGN COMPUTATIONS

HYDROLOGY & HYDRAULICS None available.
 DAM STABILITY None available.
 SEEPAGE STUDIES None available.

MATERIALS INVESTIGATIONS
 BORING RECORDS
 LABORATORY None
 FIELD None

Construction Drawings 30016 and 30034 show subsurface profile based on apparent borings and test pits.

POST-CONSTRUCTION SURVEYS OF DAM

A survey was conducted in 1969 for remedial work on the spillway.

BORROW SOURCES

Not known - probably from within reservoir.

ITEM	REMARKS	ID # PA-272	SHEET 3
------	---------	-------------	---------

MONITORING SYSTEMS

None.

MODIFICATIONS

Drawings and correspondence indicate spillway was repaired in 1931, 1936, and 1969.

HIGH POOL RECORDS

Mr. Ray Black (production superintendent) recalls a storm in 1954 passing about 58 inches over the spillway crest.

POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS

1. Several inspections by predecessors of PennDER from 1919 to 1964 in files.
2. A model study by predecessors of PennDER to evaluate spillway capacity also in files.
3. Owner conducting inspection since 1977 for insurance application. Copy of 1977 report reviewed by GAI.

PRIOR ACCIDENTS OR FAILURE OF DAM

DESCRIPTION REPORTS

Corewall overtopped during construction as per PennDER records. Minimal damage. According to water company personnel, several of the concrete slabs within the spillway outlet channel were removed in 1954 during high flow associated with hurricane "Hazel".

MAINTENANCE OPERATION RECORDS

No formal manuals. Embankment is mowed regularly. Caretaker and helper police area daily (limited recreational use). Facility basically self-regulating. All valves are opened at dam and flow is regulated at treatment plant. Can pump from Allegheny River into watershed of Oneida for storage.

ITEM	REMARKS	ID #	PA-272	SHEET 4
SPILLWAY PLAN	Construction Drawing 30041.			
SECTIONS	Construction Drawing 30041.			
DETAILS	Construction Drawing 30041.			

OPERATING EQUIPMENT
PLANS & DETAILS

Construction Drawing 30044 and 30047 (gate house).
Construction Drawing 30037-H and 30040-H - Steel pipe and CI Fittings
for Lake Oneida Dam (contained within PennDER files).

A publication entitled, "Contingency Emergency Plan to Maintain Safe Potable Water Delivery to Consumers of Western Pennsylvania Water Company - Butler District", is available at Butler office. This plan contains complete telephone listing for local supervisory personnel, radio, DER, police, fire department, etc.

NDI# PA-272
ID # PennDER# 10-11

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 75% woodlands; 25% residential/cultivated
ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1058.8 (1760 acre-feet)
ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not applicable
ELEVATION MAXIMUM DESIGN POOL: Not known
ELEVATION TOP DAM: 1067.5 (3350 acre-feet)

SPILLWAY DATA:

- a. Crest Elevation 1058.8 MLS
 - b. Type Modified side channel with broad-crested weir
 - c. Weir Length 129.5 feet, measured
 - d. Channel Length approximately 350 feet
 - e. Location Spillover right abutment
 - f. Number and Type of Gates ungated
- OUTLET WORKS:
- a. 30-inch steel, concrete enacted, main supply line to water treatment plant.
 - b. 30-inch steel blow-off encased in concrete
 - a. Type Entrance at gate house; blowoff exit about 300' d/w
 - b. Location of crest in old stream
 - c. Entrance Inverts 1028.6
 - d. Exit Inverts 1028.3 (blow-off)
 - e. Emergency Draindown Facilities 30-inch sluice valve operated from gate house.

HYDROMETEOROLOGICAL GAGES:

- a. Type Rain gage
- b. Location Thorn Run Reservoir (nearby)
- c. Records Last 6 to 7 years available at Butler Office (WPWG)

MAXIMUM NON-DAMAGING DISCHARGE: 58 inches over crest in 1954

Note: All elevations are field measured based on the spillway crest (1058.8) supplied by the Owner.

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

DAM NAME Lake Oneida Dam COUNTY Butler STATE PA NDI# PA-272
TYPE OF DAM Earth HAZARD CATEGORY High ID # PennDER# 10-11
DATE(S) INSPECTION 30 August 78 WEATHER Overcast w/ TEMPERATURE 70°-75°
light rain

POOL ELEVATION AT TIME OF INSPECTION 1058.7 M.S.L. TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL:

GAI

B. Mihalcin

J. P. Nairn

D. Bonk

E. Mannella

S. R. Michalski

WPW Co.

W. H. McAdams

R. Black

A. Reeder

B. Mihalcin

RECORDER

PennDER

L. Busack

EMBANKMENT

ID#

PA-272

Sheet 1

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SURFACE CRACKS

None observed.

UNUSUAL MOVEMENT OR

CRACKING AT OR BEYOND

THE TOE

None observed.

SLOUGHING OR EROSION OF

EMBANKMENT AND ABUTMENT

SLOPES

None observed.

VERTICAL AND HORIZONTAL

ALIGNMENT OF THE CREST

The horizontal alignment appears to be good however, minor settlement deviates the vertical alignment by a maximum of one foot.

RIPRAE FAILURES

None observed.

EMBANKMENT

ID #

PA-272

SHEET 2

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

Good condition.

ANY NOTICEABLE SEEPAGE

Slight seepage at toe near center of embankment - possibly from toe drain or drain laterals. Terra-cotta drain tiles were located in the flat beyond the toe and a t.c. exit was found at the old stream location about 110 feet from the embankment toe.

STAFF GAGE AND RECORDER

None observed. There is a bench mark (painted yellow) indicated on the top of the left wingall to the spillway.

DRAINS

1. Square terra-cotta tiles are evident in flat beyond toe of dam. They probably connect into toe drain laterals. An exit was located in the natural streambed about 130 feet from the toe. Flow was minimal, less than 1 gpm.
2. Evidence of a t.c. drain was noted near the left abutment approximately 45 feet from the toe of the dam and 27 feet below the crest. Correspondence indicates old spring location.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CRACKING AND SPALLING OF
CONCRETE SURFACES IN
OUTLET CONDUIT

Single crack visible at discharge end of 30-inch cast iron pipe (outlet conduit) located in downstream channel adjacent to left abutment.

INTAKE STRUCTURE

Intake submerged. Masonry gate house in need of structural repair due to cracking. Access bridge in good condition.

OUTLET STRUCTURE

No outlet structures.

OUTLET CHANNEL

Blow-off (30-inch CIP) exits into pool at natural stream channel. About 400 feet downstream of embankment, channel is densely wooded.

EMERGENCY GATE

Manual valve controls observed within gate house appeared in good condition. 30-inch blow-off has sliding gate. Supply line has gate valves. Supply line reportedly has 6-inch blow-off connected - not observed. The condition and operability of the lines and their controls is suspect since they have reportedly not been operated in years and were not operated in the presence of the inspection team.

UNGATED SPILLWAY

ID #

PA-272

SHEET 4

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

CONCRETE WEIR

Good condition. Minor to moderate scaling of weir walls. Could use surface treatment.

APPROACH CHANNEL

Submerged. Riprap lined on right abutment.

DISCHARGE CHANNEL

- a. From weir to downstream access bridge (about 150 feet) - apron in good condition; minor cracking in wingwalls; little efflorescence; construction joints o.k.; access bridge in good condition.
- b. From access bridge to end of spillway channel - Poor condition; 70-foot diameter erosional depression immediately downstream of bridge; 60-foot from toe of embankment.

BRIDGE AND PIERS

Foot bridge across spillway in good condition.

GATED SPILLWAY

ID # PA-272

SHEET 5

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

CONCRETE SILL

N/A

APPROACH CHANNEL

N/A

DISCHARGE CHANNEL

N/A

BRIDGE AND PIERS

N/A

GATES AND OPERATION
EQUIPMENT

N/A

INSTRUMENTATION

ID # PA-272

SHEET 6

VISUAL EXAMINATION

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS

Bench mark (yellow paint mark) on top of left wingwall to spillway.

OBSERVATION WELLS

None.

WEIRS

None.

PIEDOMETERS

None.

OTHERS

None.

RESERVOIR

ID #

PA-272

SHEET 7

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

SLOPES

Moderate to steep. Cleared to top of dam elevation around reservoir, otherwise, heavily wooded.

SEDIMENTATION

Some apparent in approach channel, particularly along right abutment.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (CESTRUCTIONS, DEBRIS, ETC.)	Natural stream with brushy overgrowth. Broad valley with meandering stream.	
SLOPES	Gentle along valley bottom. Steep side slopes. Valley bottom approximately 600 to 1000 feet wide.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approxiamtely 20 structures within two miles of dam. Estimated population 60 to 80.	

APPENDIX C
HYDRAULICS/HYDROLOGY

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJM DATE 9-13-78 SHEET NO. 1 OF 20



DAM STATISTICS

MAXIMUM HEIGHT - 38 FEET (REF 1: P. 99)

DRAINAGE AREA - 16.6 SQ. MI " "

STORAGE CAPACITY \approx 3350 AC-FT @ TOP OF DAM (SHEET)

SIZE CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 2: TABLE 1)

HAZARD RATING - HIGH (FIELD OBSERVATION)

REQUIRED SDF - PMF (REF 2: TABLE 3)

REFERENCES

- 1 "DAMS, RESERVOIRS, AND NATURAL LAKES," WATER RESOURCES BULLETIN, BUREAU OF ENGINEERING, HARRISBURG (1970)
- 2 "RECOMMEND GUIDELINES FOR SAFETY INSPECTION OF DAMS" DEPT. OF THE ARMY - OFFICE OF CHIEF ENGINEER, APPENDIX D
- 3 STANDARD HANDBOOK FOR CIVIL ENGINEERS, F. S. MERRITT, MCGRAW-HILL, INC., NEW YORK (1976)
- 4 "SIMULATION OF FLOW THROUGH BROAD CREST NAVIGATION DAMS WITH RADIAL GATES," R. W. SCHMITT, U. S. ARMY CORPS OF ENGINEERS, PITTSBURGH DISTRICT

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJMI DATE 9-13-78 SHEET NO. 2 OF 20



$$\text{PMF (PEAK FLOW) / AREA} = 1290 \text{ cfs / sq. mi.}$$

(REF: C OF E CURVE,
OHIO RIVER BASIN)

$$\text{PMF} = (1290 \text{ cfs / sq. mi.}) (16.6 \text{ sq. mi.}) = 21,414 \text{ cfs (ROUNDED TO 21,400 cfs)}$$

$$\text{PEAK PMF } Q = 21,414 \text{ cfs} = Q_{\text{IMAX}}$$

VOLUME OF INFLOW HYDROGRAPH

$$V = \frac{1}{2} (Q_{\text{IMAX}}) (\text{TIME})$$

$$\text{DURATION TIME} = 54 \text{ HRS}$$

(REF: C OF E CURVE,
OHIO RIVER BASIN)

$$\begin{aligned} V &= \frac{1}{2} (21,414 \text{ cfs}) (54 \text{ HRS}) (3600 \text{ SEC / HR}) (1 \text{ ACRE} / 43,560 \text{ SQ. FT.}) \\ &= 47,783 \text{ AC-FT} \end{aligned}$$

DETERMINE THE AVERAGE RUNOFF REQUIRED TO PRODUCE
THE ABOVE VOLUME OF INFLOW.

$$(47,783 \text{ AC-FT}) (1 \text{ SQ. MI.} / 640 \text{ ACRES}) (12 \text{ IN. / FT.}) / (16.6 \text{ SQ. MI.}) = 54.0 \text{ INCHES}$$

VOLUMES PRODUCED BY RUNOFF IN EXCESS OF 26 INCHES
ARE TO BE RECALCULATED USING 26 INCHES AS AN UPPER
BOUND.

$$(26 \text{ INCHES}) (16.6 \text{ SQ. MI.}) (640 \text{ ACRES / SQ. MI.}) (1 \text{ FT.} / 12 \text{ IN.}) = 23,019 \text{ AC-FT}$$

$$\text{VOLUME OF INFLOW (RECALCULATED)} = 23,019 \text{ AC-FT}$$

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
 B DLB DATE 9-1-78 PROJ. NO. 78-501-272
 CHKD. BY EJM DATE 9-13-78 SHEET NO. 3 OF 20

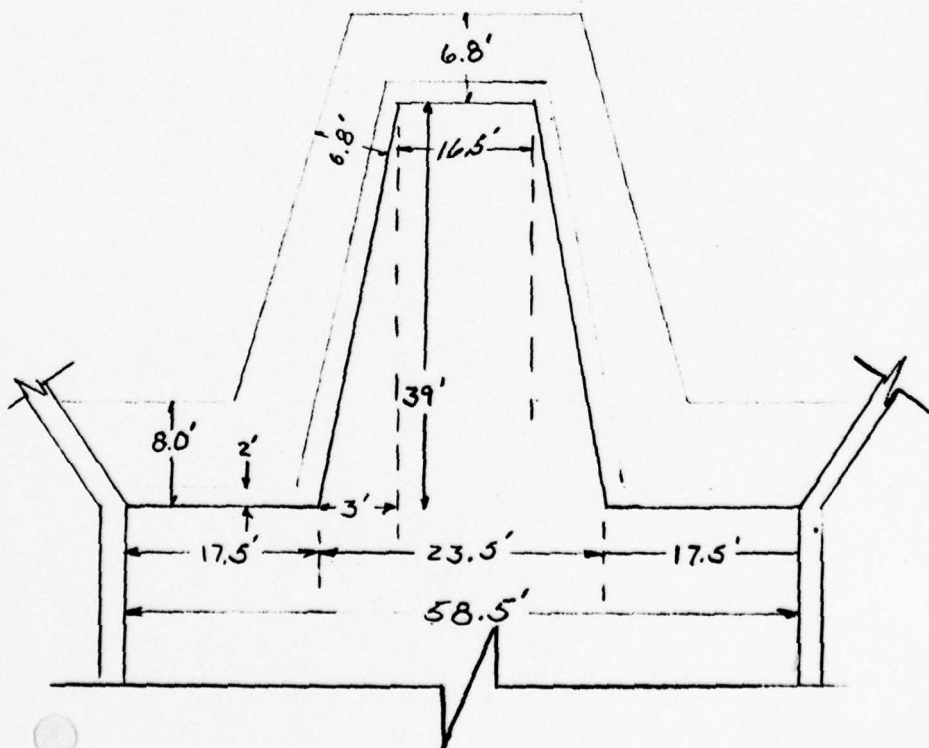
gai
 CONSULTANTS, INC.
 Engineers • Geologists • Planners
 Environmental Specialists

NOTE : Q_{IMAX} REMAINS CONSTANT.
 DURATION TIME DECREASES IN ACCORDANCE
 WITH THE DECREASE IN INFLOW VOLUME.

$$\text{EQUIVALENT DURATION TIME} = \frac{(23,019 \text{ AC-FT})(2)(43,560 \text{ SQ.FT/ACRE})}{(21,414 \text{ CFS})(3600 \text{ SEC/HR})}$$

$$= 26.0 \text{ HRS}$$

SPILLWAY CAPACITY

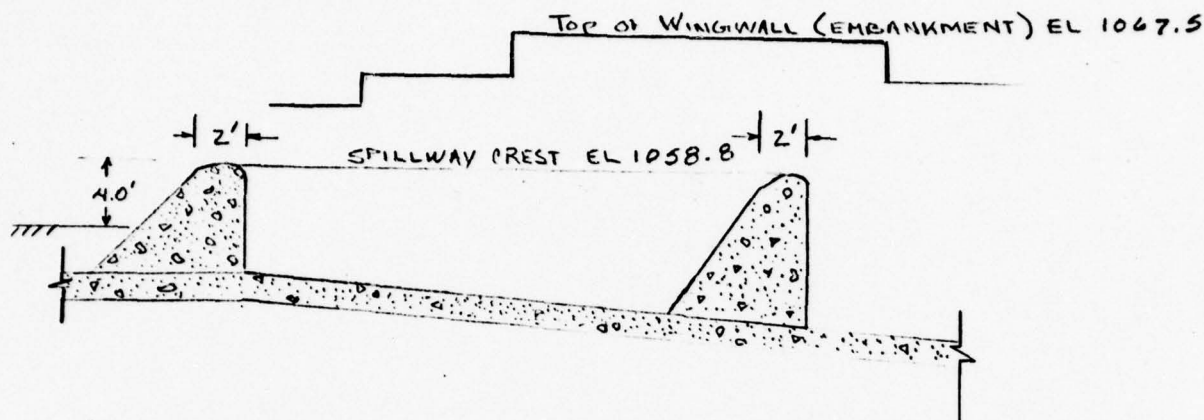


NOTE : DIMENSIONS ARE
 BASED ON DESIGN
 DRAWING TITLED "LAKE
 ONEIDA DAM, SPILLWAY
 & WEIR" REVISED ON
 JULY 15, 1910. FIELD
 VERIFIED DIMENSIONS
 DIFFER SLIGHTLY FROM
 FROM THOSE ON THE DRAWINGS

DIMENSIONS SHOWN ON THIS SECTION
 ARE FIELD MEASURED

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
 BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
 CHKD. BY EJM DATE 9-13-78 SHEET NO. 4 OF 20

gci
 CONSULTANTS, INC.
 Engineers • Geologists • Planners
 Environmental Specialists



NOTE - ALL ELEVATIONS ARE FIELD MEASURED AND BASED ON THE ELEVATION OF THE SPILLWAY CREST 1058.8 SUPPLIED BY THE OWNER. ASSUMED MINOR CREST SETTLEMENTS RESTORED TO PROPER GRADE [MAXIMUM MEASURED EMBANKMENT SETTLEMENT APPROXIMATELY EQUALS 0.7 FEET].

$$Q = CLH^{3/2}$$

(REF 3, EQ 21-121)

L = LENGTH OF WEIR = 129.5 FEET

(SHEET 3)

H = MAXIMUM HEAD OVER SPILLWAY CREST =
 1067.5 - 1058.8 = 8.7 FT.

C = COEFFICIENT OF DISCHARGE

(FROM REF 3, TABLE 21-15)

BREADTH OF CREST OF WEIR = 2 FT

$$C \approx 3.32$$

$$Q \approx (3.32)(129.5)(8.7)^{3/2} \approx 11033 \text{ CFS} \quad (\text{ROUNDED TO } 11,000 \text{ CFS})$$

PEAK PMF Q (21,400 CFS) > MAXIMUM DISCHARGE (11,000 CFS)

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
 BY DLB DATE 9-1-78 PROJ. NO. 78-501-277
 CHKD. BY EJM DATE 9-13-78 SHEET NO. 5 OF 20



CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE
 USING THE SHORT CUT METHOD AS RECOMMENDED BY NAD

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{11,033 \text{ CFS}}{21,414 \text{ CFS}} \quad \begin{matrix} (\text{SHEET 4}) \\ (\text{SHEET 2}) \end{matrix}$$

$$P = 0.52$$

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{INFLOW VOLUME}} = 0.48$$

$$\begin{aligned} \text{REQUIRED RESERVOIR STORAGE} &= (0.48)(23,019 \text{ AC-FT}) \\ &= 11,049 \text{ AC-FT} \quad \begin{matrix} \leftarrow (\text{SHEET 2}) \\ (\text{ROUNDED TO } 11,000 \text{ AC-FT}) \end{matrix} \end{aligned}$$

CALCULATE STORAGE AVAILABLE

RESERVOIR SURFACE (@ NORMAL POOL) \approx 155 ACRES (PLANIMETERED OFF U.S.G.S
 7.5 MINUTE MAP)
 RESERVOIR SURFACE (@ TOP OF DAM) \approx 210 ACRES " "

$$\text{AVAILABLE FREEBOARD} = 8.7 \text{ FEET} \quad (\text{SHEET 4})$$

$$\text{AVAILABLE STORAGE} = [(210 + 155) \text{ ACRES} / 2] (8.7 \text{ FT}) \approx 1588 \text{ AC-FT} \quad \begin{matrix} \leftarrow \\ (\text{ROUNDED TO } 1600 \text{ AC-FT}) \end{matrix}$$

$$\text{AVAILABLE STORAGE (1600 AC-FT)} < \text{REQUIRED STORAGE (11,000 AC-FT)}$$

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
 DATE 9-1-78 PROJ. NO. 78-501-272
 IKD. BY EJM DATE 9-13-78 SHEET NO. 6 OF 20



ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED
 BASED ON THE ASSUMPTIONS AND CRITERIA ON THE PREVIOUS
 FIVE PAGES.

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1588 \text{ AC-FT}}{(\frac{1}{2})(Q_{\text{PMF}})(26 \text{ HRS})(3600 \text{ SEC/HR})(1 \text{ AC}/43,560 \text{ FT}^2)}$$

$$P = \frac{11,033 \text{ CFS}}{Q_{\text{PMF}}}$$

$$\therefore 1 - \frac{11,033}{Q_{\text{PMF}}} = \frac{1588}{1.07 Q_{\text{PMF}}}$$

$$1.07 Q_{\text{PMF}} - 11805 = 1588$$

$$Q_{\text{PMF}} = 12,517 \text{ CFS}$$

$$\text{PEAK PMF } Q = 21,414 \text{ CFS}$$

(SHEET 2)

$$Q_{\text{PMF}} = 58.5\% \text{ PEAK PMF } Q$$

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
BY DLP DATE 9-1-78 PROJ. NO. 78-501-272
HKD EJM DATE 9-13-78 SHEET NO. 7 OF 20



CONSIDER THE SPILLWAY TO DISCHARGE AS A SIMPLE WEIR WITH AN EFFECTIVE LENGTH EQUIVALENT TO THE CHANNEL OPENING (58.5 FT) UNDER HIGH HEADS.

$$Q = CLH^{3/2}$$

(REF 3, EQ 21-121)

$$L = \text{LENGTH OF WEIR} \approx 58.5 \text{ FT}$$

(SHEET 3)

$$H = 8.7 \text{ FT}$$

(SHEET 4)

$$C \approx 3.32$$

(SHEET 4)

$$Q \approx (3.32)(58.5)(8.7)^{3/2} \approx 4984 \text{ CFS (ROUNDED TO 5000 CFS)}$$

PEAK PMF Q (21,400 CFS) > MAXIMUM DISCHARGE (5000 CFS)

CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING THE SHORT CUT METHOD AS RECOMMENDED BY NAD

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{4984 \text{ CFS}}{21,414 \text{ CFS}}$$

(SHEET 7)

$$P = 0.23$$

$$(1-P) = \frac{\text{REQUIRED STORAGE}}{\text{INFLOW VOLUME}} = 0.77$$

$$\text{REQUIRED STORAGE} = (0.77)(23,019 \text{ AC-FT})$$

(SHEET 2)

$$\text{REQUIRED STORAGE} = 17,725 \text{ AC-FT (ROUNDED TO 17,700 AC-FT)}$$

$$\text{REQUIRED STORAGE (17,700 AC-FT)} > \text{AVAILABLE STORAGE (1600 AC-FT)}$$

SUBJECT DAM SAFETY INSPECTION
LAKE ONSIDA DAM
 BY CLB DATE 9-1-78 PROJ. NO. 78-501-272
 HKD. BY EJM DATE 9-13-78 SHEET NO. 8 OF 20



Engineers • Geologists • Planners
Environmental Specialists

ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED
BASED ON THE ASSUMPTIONS AND CRITERIA ON SHEET 7.

$$P = \frac{4984 \text{ CFS}}{Q_{\text{IMAX}}}$$

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1588}{1.07 Q_{\text{IMAX}}} \quad \begin{matrix} (\text{SHEET 5}) \\ (\text{SHEET 6}) \end{matrix}$$

$$\therefore 1 - \frac{4984}{Q_{\text{IMAX}}} = \frac{1588}{1.07 Q_{\text{IMAX}}}$$

$$1.07 Q_{\text{IMAX}} - 5,333 = 1588$$

$$Q_{\text{IMAX}} = 6468 \text{ CFS}$$

$$\text{PEAK PMF } Q = 21,414 \text{ CFS} \quad (\text{SHEET 2})$$

$$Q_{\text{IMAX}} = 30.2 \% \text{ PEAK PMF } Q$$

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
 BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
 CHKD. BY EJM DATE 9-13-78 SHEET NO. 9 OF 28



A MEMORANDUM CONTAINED WITHIN PENNDER FILES AND DATED 6 APRIL 1949 STATES THAT THE OWNER CLAIMS THE SPILLWAY AT LAKE ONEIDA DAM HAS A CAPACITY OF APPROXIMATELY 8300 CFS.

DETERMINE WHAT PERCENT PMF IS PASSED AND/OR CONTAINED WHEN THE SPILLWAY IS ASSUMED TO HAVE A CAPACITY EQUIVALENT TO 8300 CFS.

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{8300 \text{ CFS}}{21,414 \text{ CFS}} \quad (\text{SHEET 2})$$

$$P = 0.39$$

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{INFLOW VOLUME}} = (1-0.39) = 0.61$$

$$\text{INFLOW VOLUME} = 23,019 \text{ AC-FT} \quad (\text{SHEET 2})$$

$$\text{REQUIRED STORAGE} = 14049 \text{ AC-FT (ROUNDED TO 14,000 AC-FT)} \quad (\text{SHEET 5})$$

$$\text{STORAGE AVAILABLE} = 1600 \text{ AC-FT} \quad (\text{SHEET 5})$$

$$\text{REQUIRED STORAGE (14000 AC-FT)} > \text{AVAILABLE STORAGE (1600 AC-FT)}$$

$$P = \frac{8300 \text{ CFS}}{Q_{\text{IMAX}}} = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q}$$

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1588}{1.07 Q_{\text{IMAX}}} \quad (\text{SHEET 5})$$

(SHEET 6)

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY FJM DATE 9-13-78 SHEET NO. 10 OF 20



Engineers • Geologists • Planners
Environmental Specialists

$$\therefore 1 - \frac{8300 \text{ CFS}}{Q_{\text{IMAX}}} = \frac{1588}{1.07 Q_{\text{IMAX}}}$$

$$1.07 Q_{\text{IMAX}} - 8881 = 1588$$

$$Q_{\text{IMAX}} = 9,784 \text{ CFS}$$

$$\text{PEAK PMF } Q = 21,414 \text{ CFS}$$

$$Q_{\text{IMAX}} = 45.7\% \text{ PEAK PMF } Q$$

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
BY PLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJM DATE 9-13-78 SHEET NO. 11 OF 20



CONSIDER THE AFFECTS OF UPSTREAM RESERVOIR

BOYDSTOWN RESERVOIR

DAM STATISTICS

MAXIMUM HEIGHT - 28 FEET

(REF 1: PG 99)

DRAINAGE AREA - 13.6 SQ. MI.

" "

STORAGE CAPACITY - 528 ACRE-Feet @ TOP OF DAM

SIZE CLASSIFICATIONS

DAM SIZE - SMALL

(REF 2: TABLE 1)

HAZARD RATING - HIGH

(FIELD OBSERVATION)

REQUIRED SDF - $\frac{1}{2}$ PMF TO PMF

(REF 2: TABLE 3)

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJM DATE 9-13-78 SHEET NO. 12 OF 20



$$\text{PMF (PEAK FLOW)/AREA} = 1380 \text{ CFS/SQ. MI.} \quad (\text{REF: C OF E CURVE, OHIO RIVER BASIN})$$

$$\text{PMF} = (1380 \text{ CFS/SQ. MI.}) (13.6 \text{ SQ. MI.}) = 18768 \text{ CFS (ROUNDED TO 18,800 CFS)}$$

$$\text{PEAK PMF } Q = 18,768 \text{ CFS} = Q_{\text{MAX}}$$

VOLUME OF INFLOW HYDROGRAPH

$$V = \frac{1}{2} (Q_{\text{MAX}}) (\text{TIME})$$

$$\text{DURATION TIME} = 51 \text{ HRS}$$

$$V = \frac{1}{2} (18,768 \text{ CFS}) (51 \text{ HRS}) (3600 \text{ SEC/HR}) (1 \text{ ACRE} / 43,560 \text{ SQ. FT})$$

$$V = 39,552 \text{ AC-FT}$$

DETERMINE THE AVERAGE RUNOFF REQUIRED TO PRODUCE THE ABOVE VOLUME OF INFLOW

$$(39,552 \text{ AC-FT}) (1 \text{ SQ. MI.} / 640 \text{ ACRES}) (12 \text{ IN/FT}) / (13.6 \text{ SQ. MI.}) = 54.5 \text{ INCHES}$$

VOLUMES PRODUCED BY RUNOFF IN EXCESS OF 26 INCHES ARE TO BE RECALCULATED USING 26 INCHES AS AN UPPER BOUND.

$$(26 \text{ INCHES}) (13.6 \text{ SQ. MI.}) (640 \text{ ACRES/SQ. MI.}) (1 \text{ FT} / 12 \text{ IN}) = 18,859 \text{ AC-FT}$$

$$\text{VOLUME OF INFLOW (RECALCULATED)} = 18,859 \text{ AC-FT}$$

BOYSTOWN RESERVOIR

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
 BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
 CHKD. BY EJM DATE 9-13-78 SHEET NO. 13 OF 20

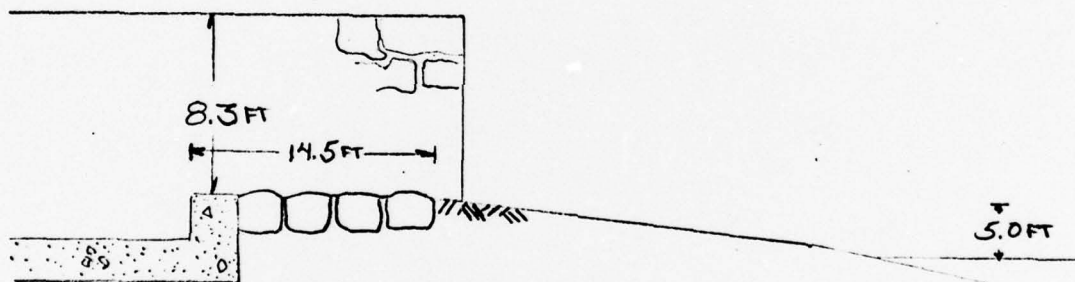
gai
 CONSULTANTS, INC.
 Engineers • Geologists • Planners
 Environmental Specialists

NOTE: Q_{IMAX} REMAINS CONSTANT.
 DURATION TIME DECREASES IN ACCORDANCE
 WITH THE DECREASE IN INFLOW VOLUME.

$$\text{EQUIVALENT DURATION TIME} = \frac{(18,859 \text{ AC-FT}) (2) (43,560 \text{ SQ. FT. / ACRE})}{(18,768 \text{ CFS}) (3600 \text{ SEC / HR})}$$

$$= 24.3 \text{ HRS}$$

SPILLWAY CAPACITY



BROAD-CRESTED WEIR

$$Q = CLH^{3/2}$$

L = LENGTH OF WEIR

H = MAXIMUM HEAD OVER SPILLWAY CREST

C = COEFFICIENT OF DISCHARGE

NOTE: THE ABOVE DIMENSIONS ARE BASED ON FIELD
 MEASUREMENTS. EMBANKMENT SETTLEMENT WAS NOT
 MEASURED,

BOYDETOWN RESERVOIR

SUBJECT

DAM SAFETY INSPECTION

LAKE CNEIDA DAM

BY DLB

DATE

9-1-78

PROJ. NO.

78-501-272

CHKD. BY EJM

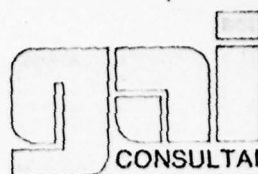
DATE

9-13-78

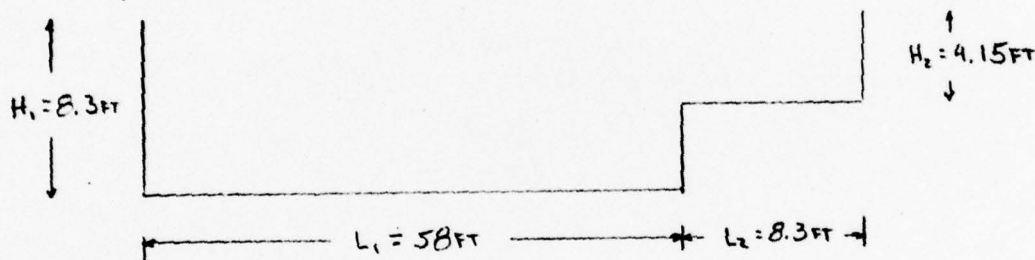
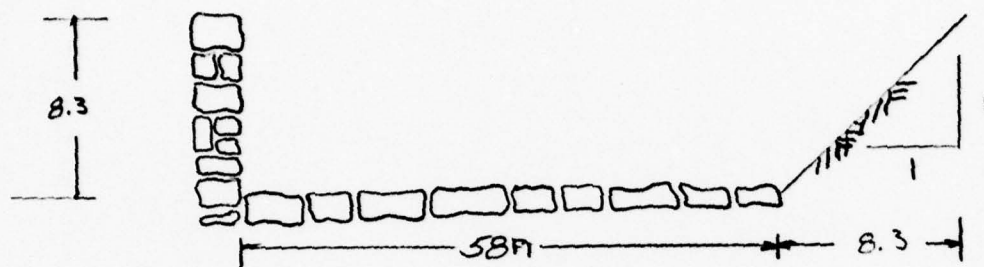
SHEET NO.

14

OF 20



CONSULTANTS, INC.

Engineers • Geologists • Planners
Environmental Specialists

$$Q_1 = C_1 L_1 H_1^{3/2}$$

$$Q_2 = C_2 L_2 H_2^{3/2}$$

$$\text{ASSUME } C_1 = C_2$$

$$\text{BASED ON } \frac{H_{\text{GROSS HEAD}}}{L_{\text{BREADTH}}} = \frac{8.3 \text{ FT}}{14.5 \text{ FT}} = 0.57$$

$$C = 3.1$$

(REF 4, FIG 3)

CRYSTOWN RESERVOIR

SUBJECT

DAM SAFETY INSPECTIONLAKE ONEIDA DAMBY DLB

DATE

9-1-78

PROJ. NO.

78-501-272CHKD. BY EJM

DATE

9-15-78

SHEET NO.

15 OF 20

CONSULTANTS, INC.

Engineers • Geologists • Planners
Environmental Specialists

$$Q_1 = (3.1)(58)(8.3)^{3/2} = 4299 \text{ CFS}$$

$$Q_2 = (3.1)(8.3)(4.15)^{3/2} = 218 \text{ CFS}$$

$$Q_1 + Q_2 = 4517 \text{ CFS (Rounded to 4500 CFS)}$$

$$\text{PEAK PMF } Q (18,800 \text{ CFS}) > \text{MAXIMUM DISCHARGE (4500 CFS)}$$

—

CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{4517 \text{ CFS}}{18,768 \text{ CFS}} = 0.24$$

$$(1-P) = \frac{\text{REQUIRED STORAGE}}{\text{INFLOW VOLUME}} = (1-0.24) = 0.76$$

$$\text{REQUIRED STORAGE} = (0.76)(18,859 \text{ AC-FT}) \quad \leftarrow \text{(SHEET 12)}$$

$$\text{REQUIRED STORAGE} = 14,333 \text{ AC-FT (Rounded to 14,300 AC-FT)}$$

$$\text{STORAGE AVAILABLE} \leq 307 \text{ AC-FT} \quad (\text{SEE NOTE ON PAGE 16})$$

$$\text{REQUIRED STORAGE (14,300 AC-FT)} \gg \text{AVAILABLE STORAGE (307 AC-FT)}$$

BOYDSTOWN RESERVOIR

SUBJECT

DAM SAFETY INSPECTIONLAKE ONEIDA DAM

B

DLB

DATE

9-1-78

PROJ. NO.

78-501-272

CHKD. BY

EJM

DATE

9-13-78

SHEET NO.

16 OF 20Engineers • Geologists • Planners
Environmental Specialists

NOTE: STORAGE AVAILABLE IS GIVEN WITHIN THE TEXT OF A
MEMORANDUM DATED 3 MAY 1949 AND CONTAINED
WITHIN PENNDER FILES

ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED
BY BOYDSTOWN RESERVOIR DAM BASED ON THE ASSUMPTIONS AND
CRITERIA DEVELOPED ON THE PREVIOUS PAGES.

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{4517 \text{ CFS}}{Q_{\text{IMAX}}} \quad (\text{SHEET 15})$$

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{307 \text{ AC-FT}}{1.07 Q_{\text{IMAX}}} \quad \begin{matrix} (\text{SHEET 15}) \\ (\text{SHEET 6}) \end{matrix}$$

$$\therefore 1 - \frac{4517}{Q_{\text{IMAX}}} = \frac{307}{1.07 Q_{\text{IMAX}}}$$

$$1.07 Q_{\text{IMAX}} - 4833 = 307$$

$$Q_{\text{IMAX}} = 4804 \text{ CFS}$$

$$\text{PEAK PMF } Q = 18768 \text{ CFS} \quad (\text{SHEET 12})$$

$$Q_{\text{IMAX}} = 25.6 \%$$

NOTE: AVAILABLE STORAGE ABOVE THE SPILLWAY CREST IS TAKEN FROM
A MEMORANDUM CONTAINED IN PENNDER FILES DATED 3 MAY 1949.

BOYDSTOWN RESERVOIR

SUBJECT DAM SAFETY INSPECTION

LAKE ONTARIO DAM

BY DLB DATE 9-25-78 PROJ. NO. 78-501-272

CHKD. BY JAN DATE 9-26-78 SHEET NO. 17 OF 20



CONSIDER THE OVERALL LOSS IN SPILLWAY EFFICIENCY DUE TO THE MEASURED CREST SETTLEMENT OF APPROXIMATELY 0.7 FEET AS PREVIOUSLY STATED ON SHEET 4.

SPILLWAY CAPACITY (SEE SHEETS 4 & 7)

$$Q = CLH^{3/2}$$

$$L = 129.5 \text{ FEET OR } 58.5 \text{ FEET}$$

NOTE: THE PERCENTAGE DECREASE IN OVERALL EFFICIENCY WILL NOT BE THE SAME FOR BOTH THE ABOVE CASES (129.5 FT AND/OR 58.5 FT). CONSEQUENTLY, BOTH CASES MUST BE CONSIDERED INDIVIDUALLY.

$$H = \text{MAXIMUM HEAD OVER SPILLWAY CREST} = 8.0 \text{ FEET}$$

$$C \approx 3.32$$

$$Q \approx (3.32)(129.5)(8.0)^{3/2} \approx 9728 \text{ CFS} \quad (\text{ROUNDED TO } 9700 \text{ CFS})$$

$$\text{PEAK PMF } Q(21,400 \text{ CFS}) > \text{MAXIMUM DISCHARGE } (9700 \text{ CFS})$$

SUBJECT DAM SAFETY INSPECTION

LAKE ONEIDA DAM

BY DLP DATE 9-25-78 PROJ. NO. 78-501-272

CHKD. BY JTN DATE 9-26-78 SHEET NO. 18 OF 20



Engineers • Geologists • Planners
Environmental Specialists

CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING THE SHORT CUT METHOD AS RECOMMENDED BY NAD.

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{9728 \text{ CFS}}{21,414 \text{ CFS}} \quad \begin{matrix} \text{(SHEET 17)} \\ \text{(SHEET 2)} \end{matrix}$$

$$P = 0.45$$

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{INFLOW VOLUME}} = 0.55$$

$$\begin{aligned} \text{REQUIRED RESERVOIR STORAGE} &= (0.55)(23,019 \text{ AC-FT}) \\ &= 12,660 \text{ AC-FT} \end{aligned} \quad \begin{matrix} \text{(SHEET 2)} \end{matrix}$$

BASED ON COMPUTED STORAGE (SHEET 5) OF 1588 AC-FT AT TOP OF DAM ELEVATION 1067.5, THE STORAGE AVAILABLE AT ELEVATION 1066.8 IS ESTIMATED TO APPROXIMATELY EQUAL 1450 AC-FT

$$\text{REQUIRED STORAGE (12,660 AC-FT)} > \text{AVAILABLE STORAGE (1450 AC-FT)}$$

ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED BASED ON THE ASSUMPTIONS AND CRITERIA FROM PAGES 17 & 18.

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1450}{1.07 Q_{\text{MAX}}} \quad \begin{matrix} \text{(SHEET 18)} \\ \text{(SHEET 6)} \end{matrix}$$

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM
 BY DLB DATE 9-25-78 PROJ. NO. 78-501-272
 CHKD. BY JPI DATE 9-26-78 SHEET NO. 19 OF 20



$$P = \frac{\text{MAXIMUM DISCHARGE}}{Q_{\text{IMAX}}} = \frac{9728 \text{ cfs}}{Q_{\text{IMAX}}}$$

(SHEET 17)

$$\therefore 1 - \frac{9728}{Q_{\text{IMAX}}} = \frac{1450}{1.07 Q_{\text{IMAX}}}$$

$$1.07 Q_{\text{IMAX}} = 11,859$$

$$Q_{\text{IMAX}} = 11,083 \text{ cfs}$$

$$\text{PEAK PMF } Q = 21,414 \text{ cfs}$$

(SHEET 2)

$$Q_{\text{IMAX}} = 51.7\% \text{ PEAK PMF } Q \text{ (CONSIDERING SETTLEMENT, } L = 129.5 \text{ FT)}$$

$$Q_{\text{IMAX}} = 58.5\% \text{ PEAK PMF } Q \text{ (NEGLECTING SETTLEMENT, " ") SHEET 6}$$

$$\text{TOTAL LOSS OF EFFICIENCY } (58.5 - 51.7) = 6.8\%$$

SUBJECT DAM SAFETY INSPECTION

LAKE ONEIDA DAM

BY DLB DATE 9-25-78 PROJ. NO. 78-501-272

CHKD. BY TPW DATE 9-26-78 SHEET NO. 20 OF 20



Engineers • Geologists • Planners
Environmental Specialists

$$Q = CLH^{3/2}$$

$$L = 58.5 \text{ ft}$$

$$Q \approx (3.32)(58.5)(8.0)^{3/2}$$

$$Q \approx 4395 \text{ cfs}$$

(ROUNDED TO 4400 cfs)

PEAK PMF Q (21,400 cfs) > MAXIMUM DISCHARGE (4400 cfs)

$$P = \frac{\text{MAXIMUM DISCHARGE}}{Q_{\text{IMAX}}} = \frac{4395}{Q_{\text{IMAX}}}$$

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1450}{1.07 Q_{\text{IMAX}}}$$

(SHEET 18)
(SHEET 6)

$$\therefore 1 - \frac{4395}{Q_{\text{IMAX}}} = \frac{1450}{1.07 Q_{\text{IMAX}}}$$

$$1.07 Q_{\text{IMAX}} = 6153$$

$$Q_{\text{IMAX}} = 5750 \text{ cfs}$$

$$\text{PEAK PMF } Q = 21,414 \text{ cfs}$$

$$Q_{\text{IMAX}} = 26.8\% \text{ PEAK PMF } Q \quad (\text{CONSIDERING SETTLEMENT, } L = 58.5 \text{ ft})$$

$$Q_{\text{IMAX}} = 30.2\% \text{ PEAK PMF } Q \quad (\text{NEGLECTING SETTLEMENT, } L = 58.5 \text{ ft})$$

$$\text{TOTAL LOSS OF EFFICIENCY} = (30.2 - 26.8) = 3.4\%$$

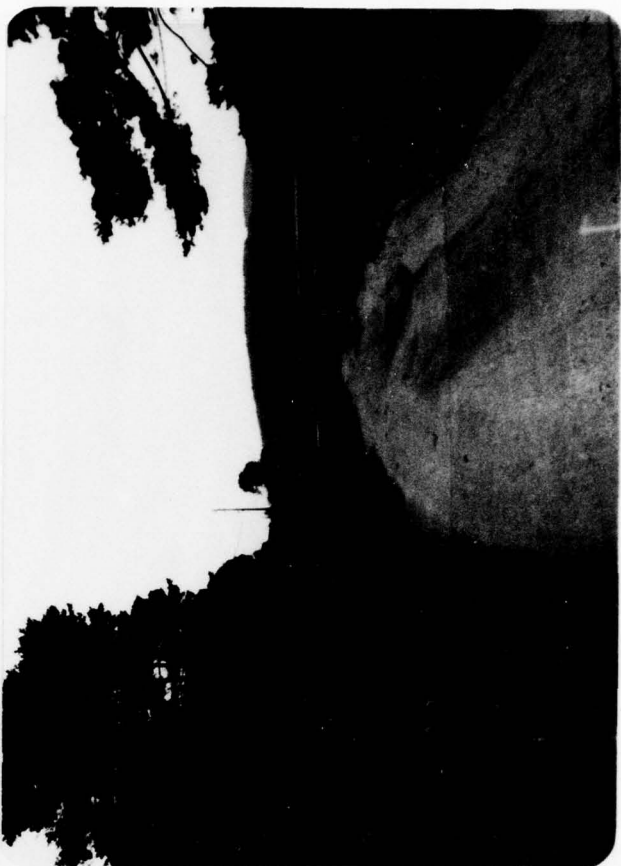
APPENDIX D
PHOTOGRAPHS

PHOTOGRAPH 1 View of Oneida Dam and spillway as seen from the right abutment.

PHOTOGRAPH 2 Detailed view of spillway weir.

PHOTOGRAPH 3 View downstream of the spillway weir.

PHOTOGRAPH 4 View of the upper spillway channel and spillway weir. The reservoir is visible in the background.



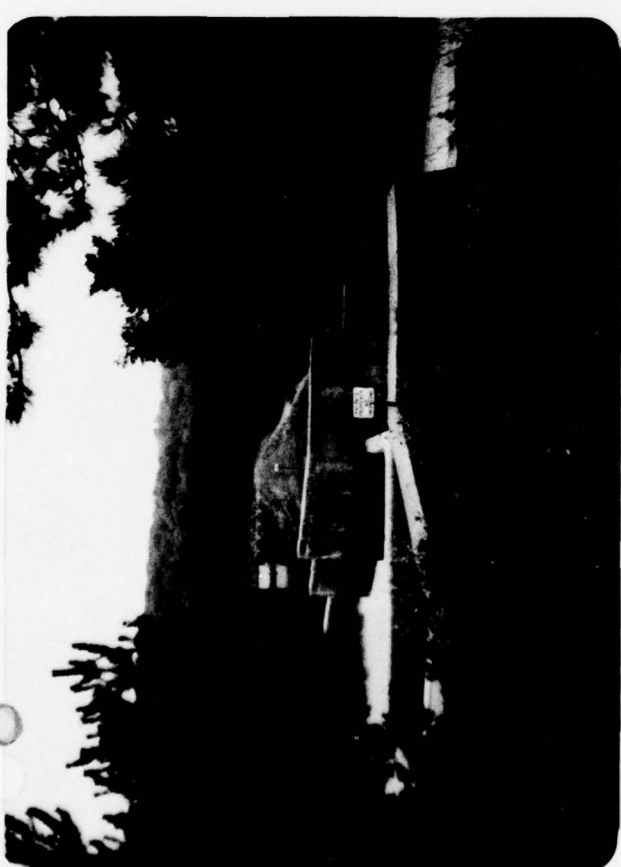
4

2



3

1

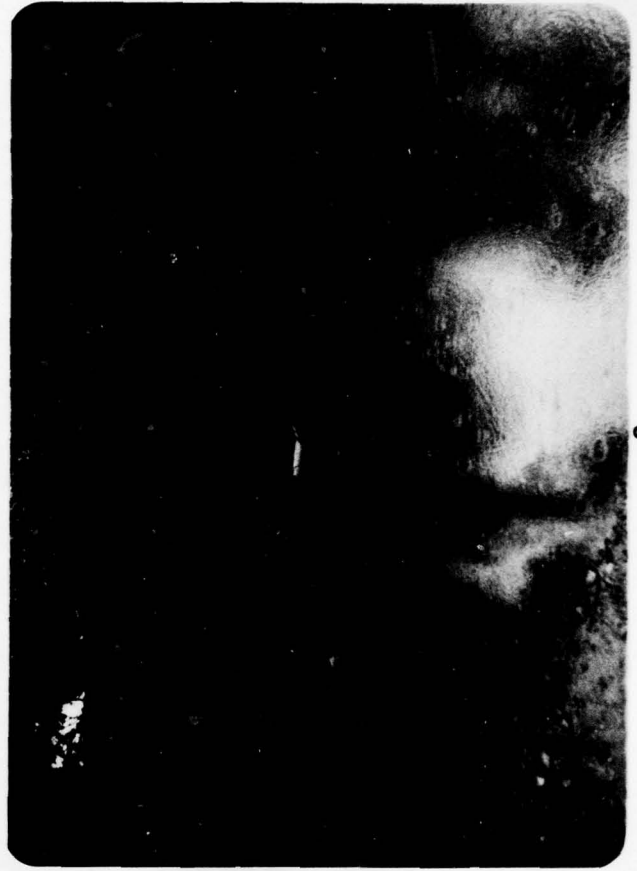


PHOTOGRAPH 5 This view shows the severe erosion of the raceway channel after failure of the concrete channel lining. The top of the erosion scarp in the upper right is 60 feet from the downstream toe of the embankment.

PHOTOGRAPH 6 This view is similar to the previous view and shows severe erosion on both sides of the raceway.

PHOTOGRAPH 7 This view shows the lower end of the lined portion of the raceway. The severe erosion shown in the previous two views can be seen in the upper left corner of the photograph. Note the dislodged concrete slabs in the foreground.

PHOTOGRAPH 8 This view shows the outlet of the 30-inch blow-off pipe.



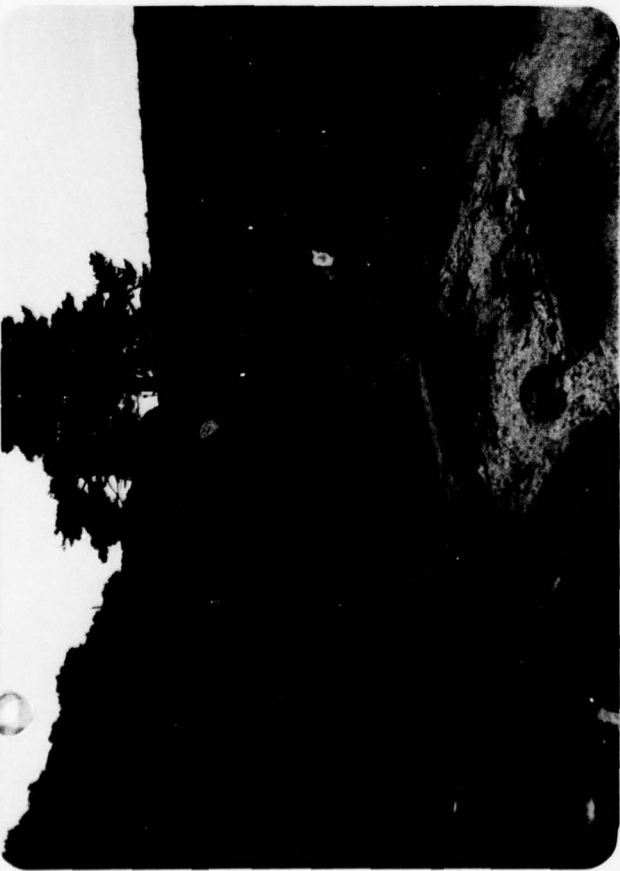
8



6



7



5

PHOTOGRAPH 9 This view is looking east along the abandoned Connoquenessing Creek channel just downstream of the embankment (center background). The low flow noted in the channel is primarily drainage from the downstream toe tile drains.

PHOTOGRAPH 10 View of Oneida Dam from the left abutment.

PHOTOGRAPH 11 This view is looking northeast over Lake Oneida.

PHOTOGRAPH 12 View of the hand-placed riprap on the upstream slope of the embankment.



9



10



11



12

PHOTOGRAPH 13 This view is looking southwest at the area immediately downstream of the dam.

PHOTOGRAPH 14 Detail showing the condition of the gate controls.

PHOTOGRAPH 15 This view is looking northeast or upstream in the Connoquenessing Creek channel at a point approximately 3,000 feet downstream of Lake Oneida.

PHOTOGRAPH 16 Overview of the Boydstown Dam which lies immediately upstream of Lake Oneida. Discharge from the blow-off outlet can be seen just left of center. The spillway is located in the foreground.



14



16



13



15

APPENDIX E

GEOLOGY

GEOLOGY

The site of the Oneida Dam and Reservoir is located in the Pittsburgh Plateaus Section of the Appalachian Plateau Province. The structural geology of the area is characterized as nearly horizontal beds gently dipping to the southwest.

The strata occupying the hilltop above the reservoir consist of sandstone, shale, limestone, and few thin coal seams of the Conemaugh Formation. The strata in the valley walls and underlying the reservoir and embankment consist of sandstone, shale, and several workable coal seams of the Allegheny Formation. The consolidated sediments of the Allegheny and Conemaugh Formations were deposited during the latter half of the Pennsylvanian age.

APPENDIX F

FIGURES

SUBJECT ONEIDA DAM

BY SRM DATE 9-12-78 PROJ. NO. 78-501-272

CHKD. BY BMW DATE 9-13-78 SHEET NO. 1 OF 1

gai
CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

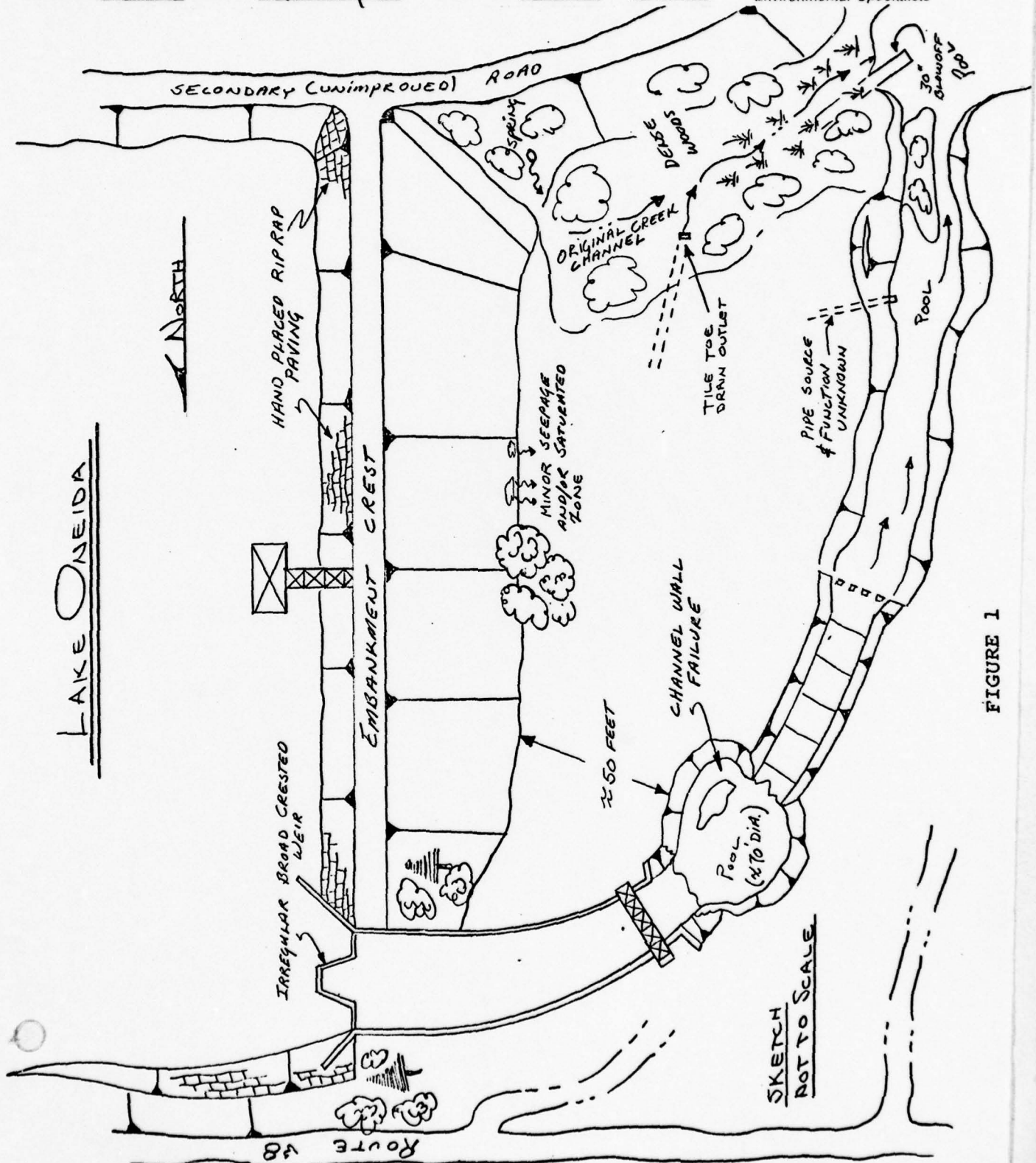
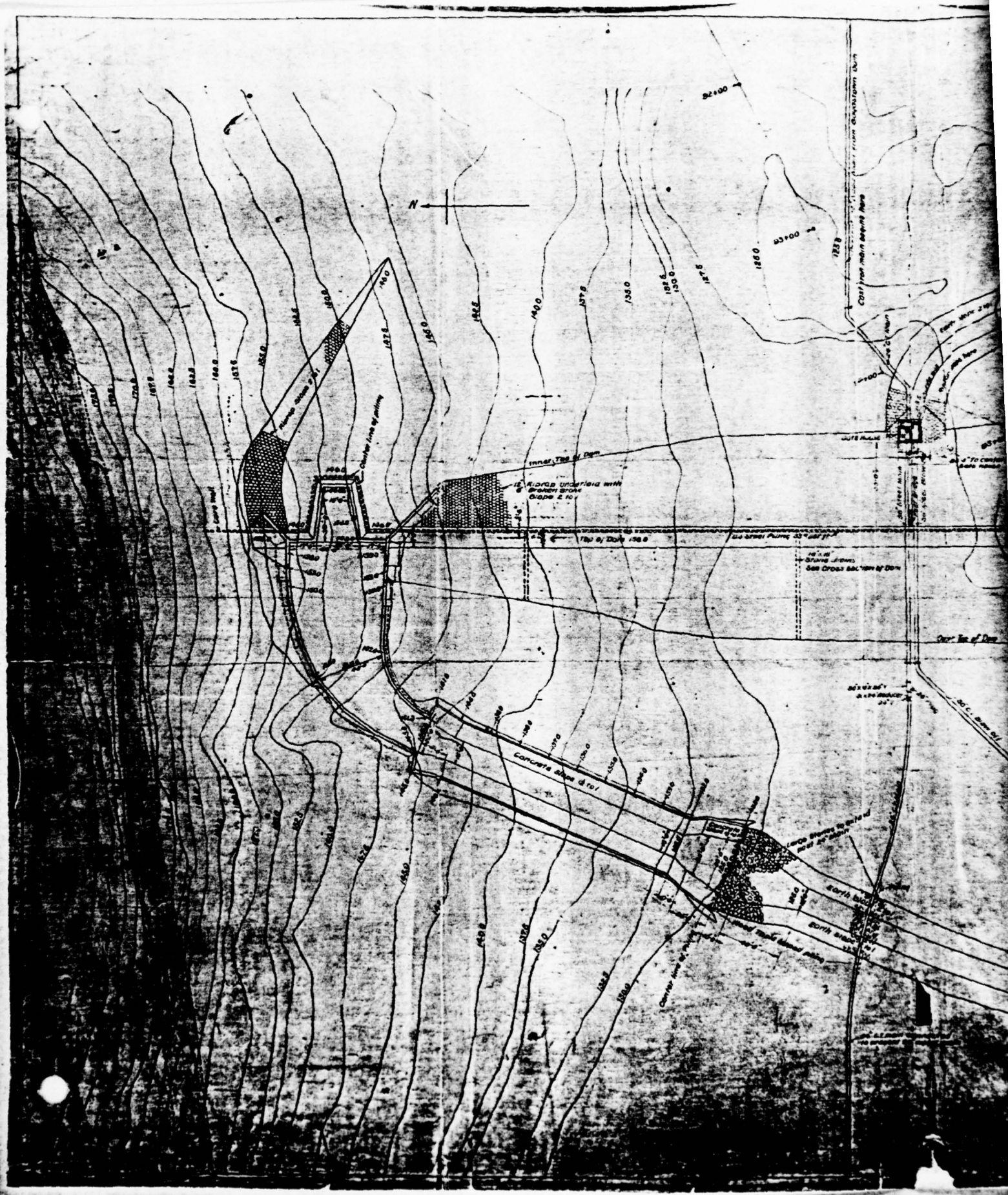
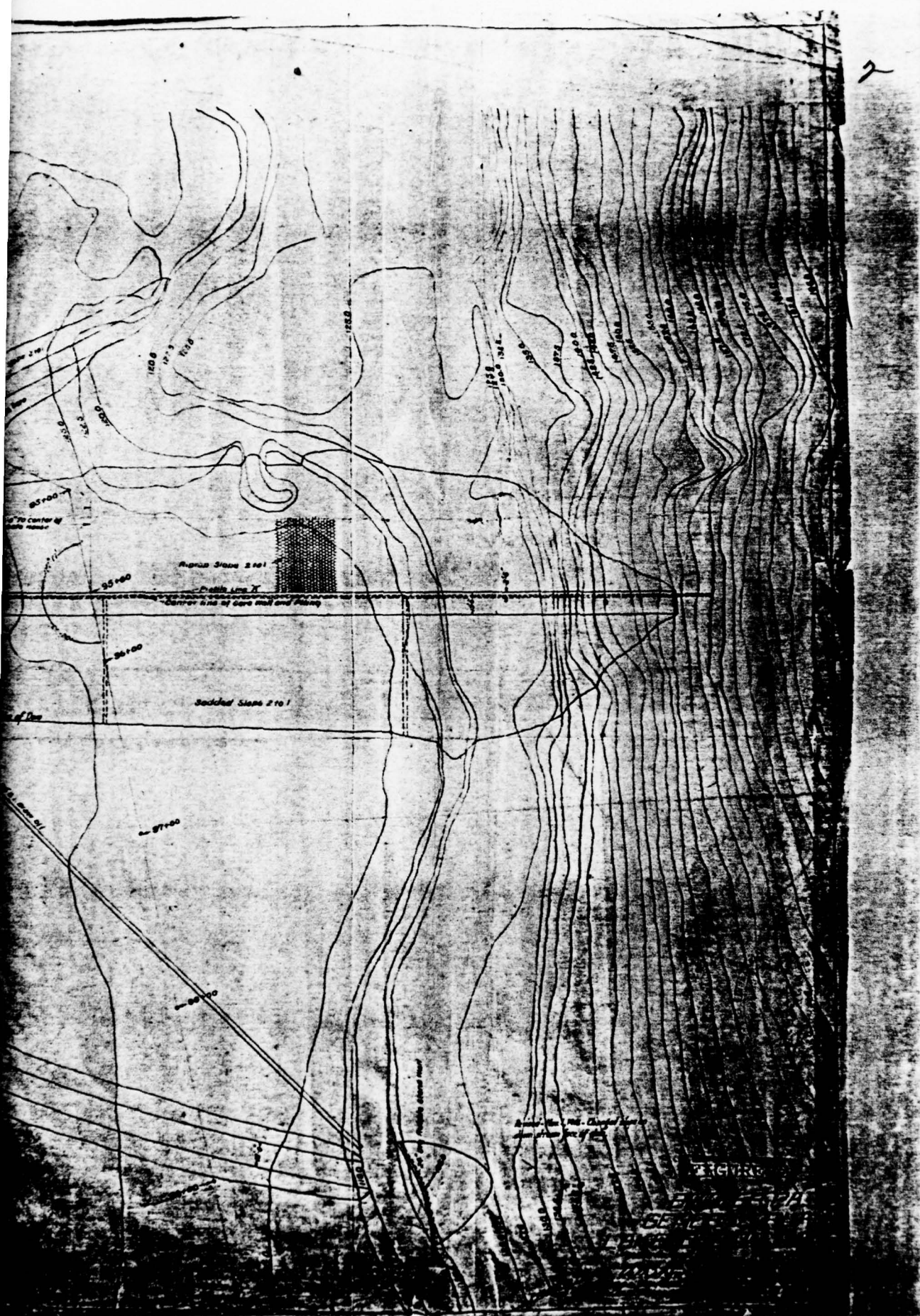
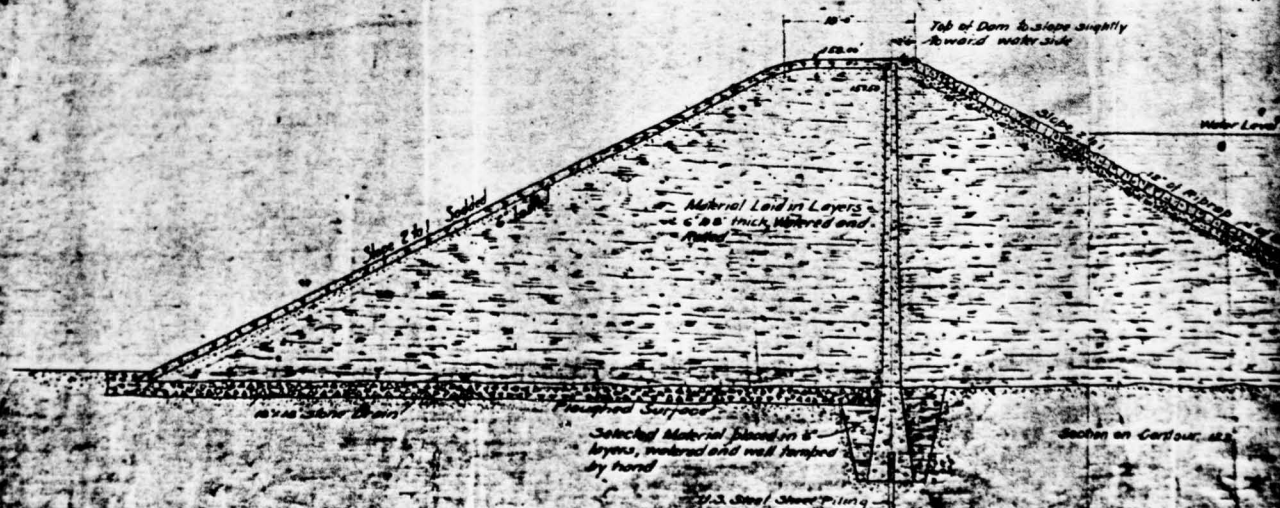
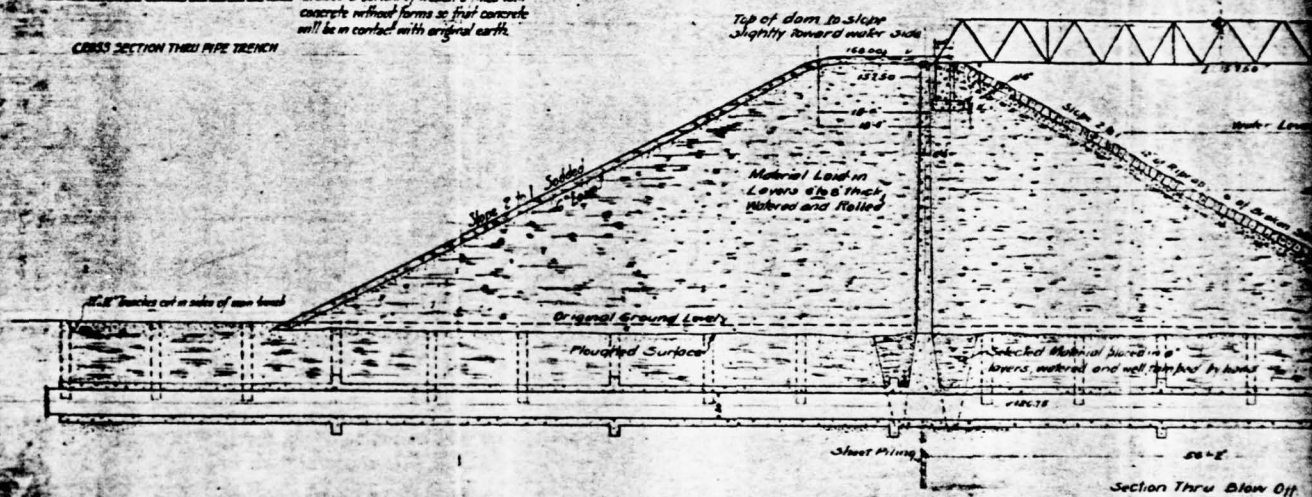
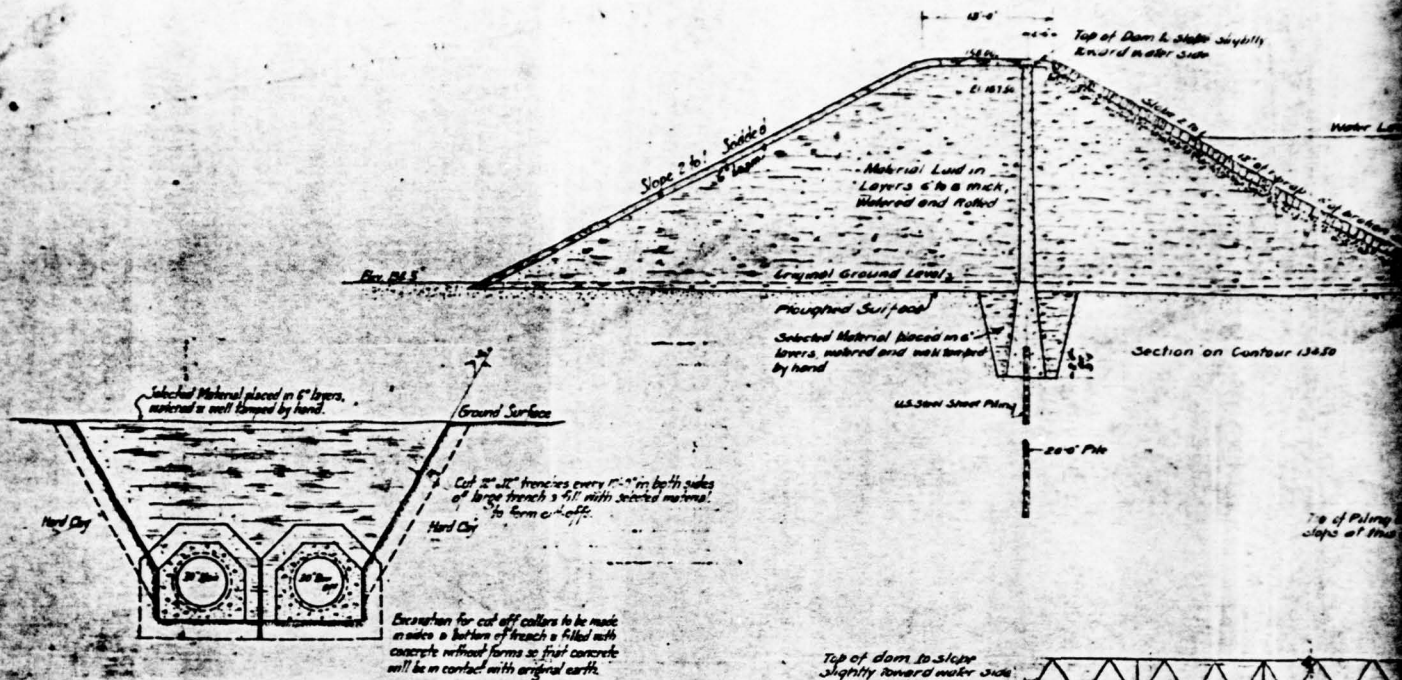
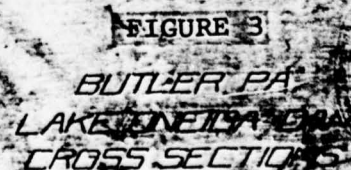


FIGURE 1









Scrub 4.5 - 5.5 Very m. dense
Drooping, 12-15
Drooping, 12-15
Drooping, 12-15

Center line of Piling

Enlarged Section of Expansion Joint

Center line of Core Wall & Piling
Line of lower face of Piling

Enlarged Section of Top of Pier Walls

All corners at intersection of vertical walls to be reinforced with 10 rods 6" CTR

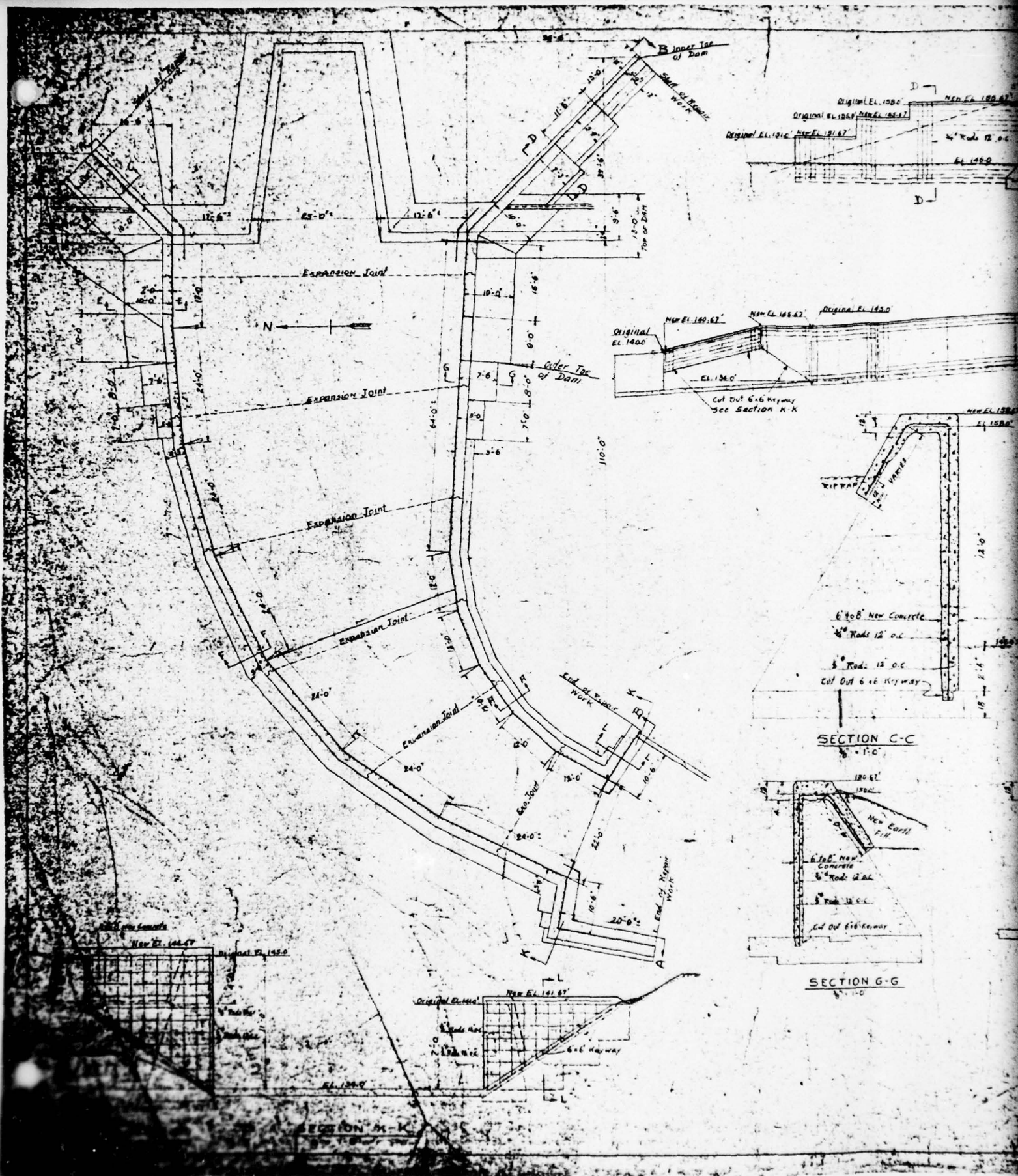
6" Concrete
Section at line D-D

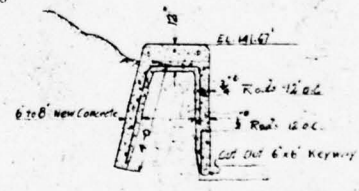
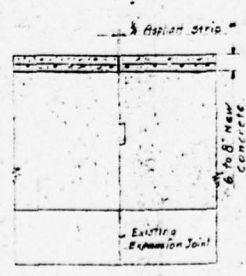
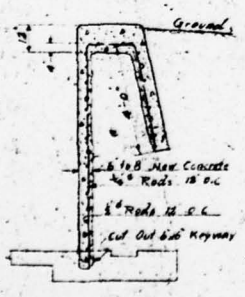
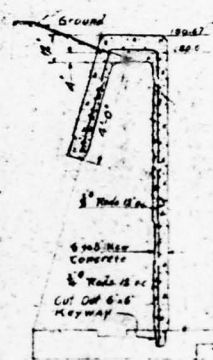
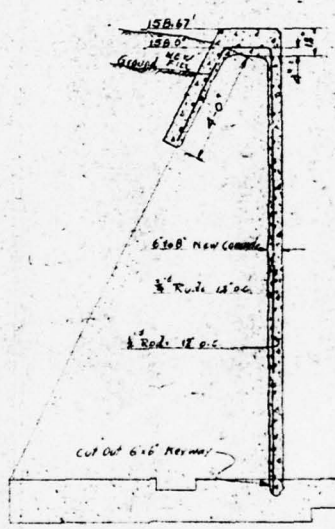
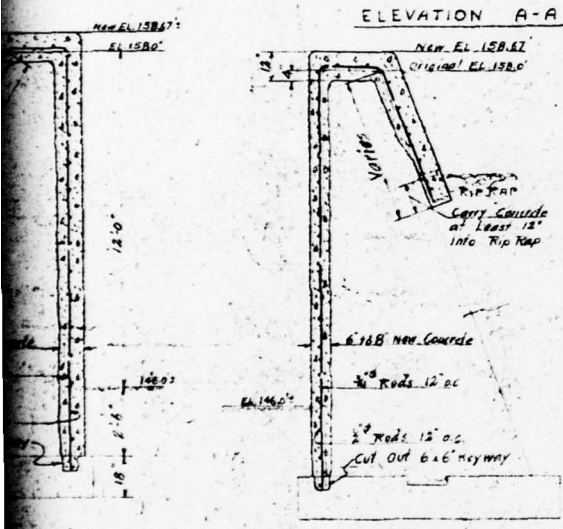
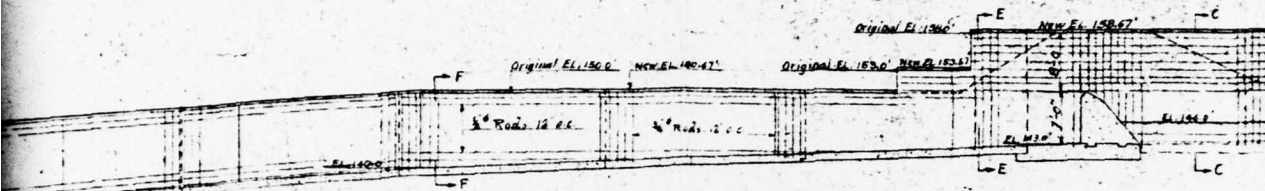
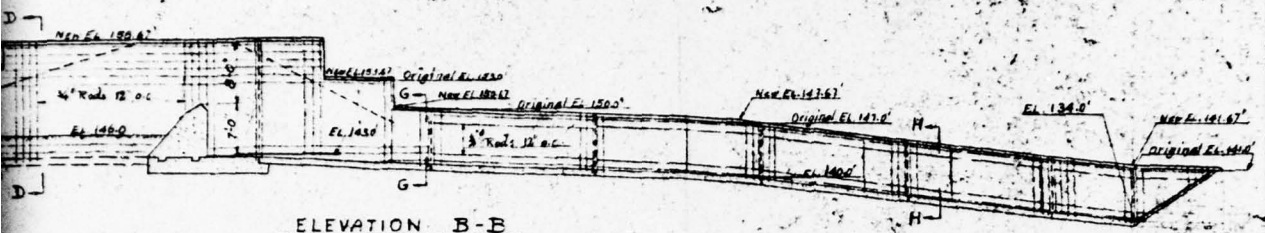
Broken Stone
6" vitrified drain tile
Do not use cement in joints

Section at line A-A
Wood shale lapped piling

Flattened bottom of Base Side of Spillway & Section through floor

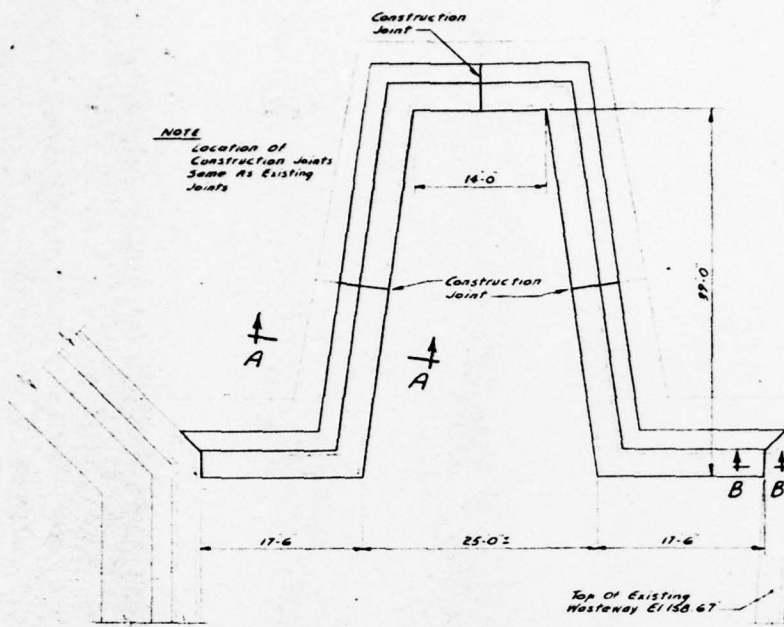
Flattened sides of Spillway with 6" CTR



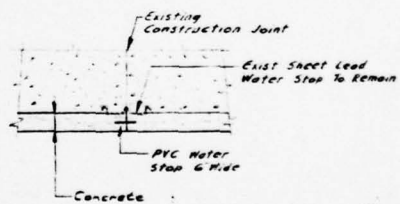
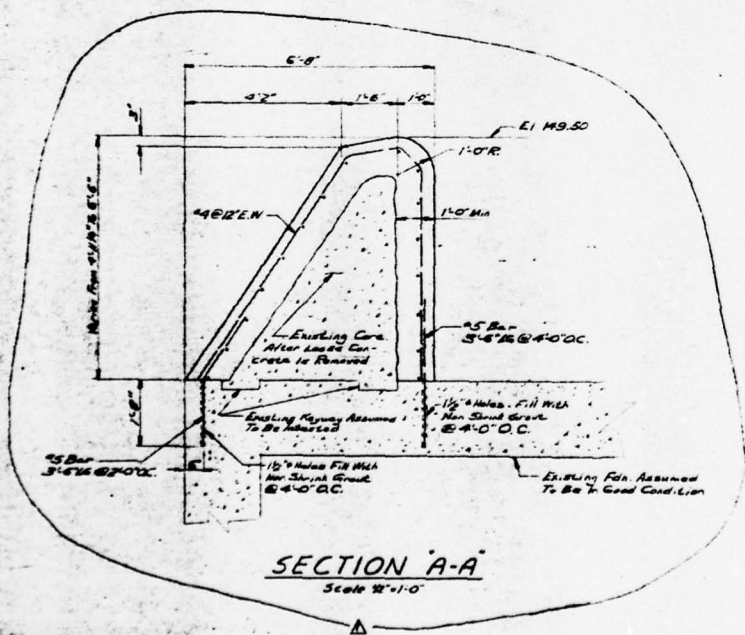


Note: All New Concrete Work To Conform To 3025a Concrete

REPAIRS TO WASTEWAY LAKE ONEIDA DAM BUTLER WATER CO. BUTLER, PA.	
WATER WORKS SERVICE CO. INC. 50 BROAD STREET NEW YORK CITY	
SCALE: 1" = 4'-0" AND NOTES	USE DIMENSIONS ONLY
DRAWN BY: M.T.S.	CHECKED BY:
APPROVED BY:	DATE:
FIGURE 5	
3-434	



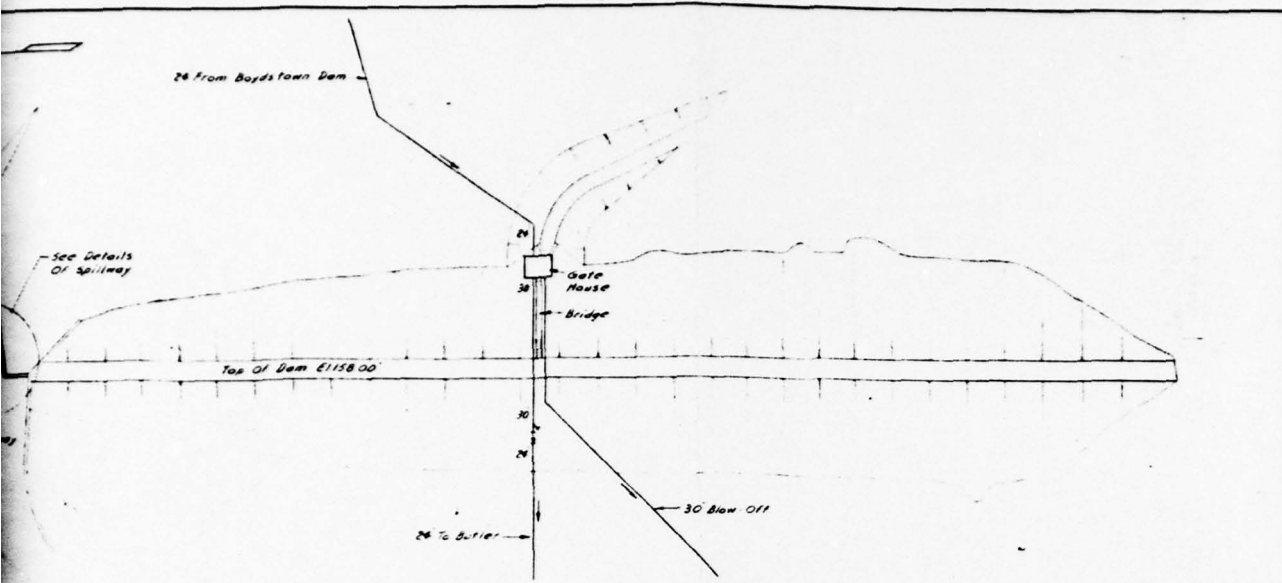
PLAN
Scale 30' = 1'-0"



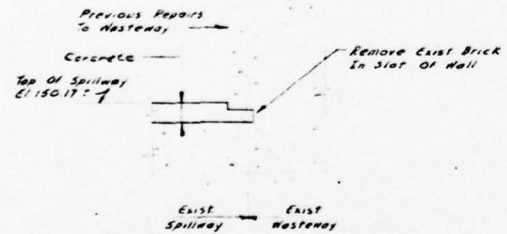
**CONSTRUCTION JOINT
DETAIL**
Scale 12' = 1'-0"

DETAILS OF SPILLWAY

2



LOCATION PLAN
Scale 1"=50'-0"



SECTION B-B
Scale 1/2"=1'-0"

REFERENCE DRAWINGS
#30034
#30056
#3-2964

NOTE
Concrete Shall Develop 3,000 PSI. Compressive Strength At 28 Days
Reinforcing Bars Shall Conform To ASTM Specification A-632
Deformations Shall Conform To ASTM Specification A-305

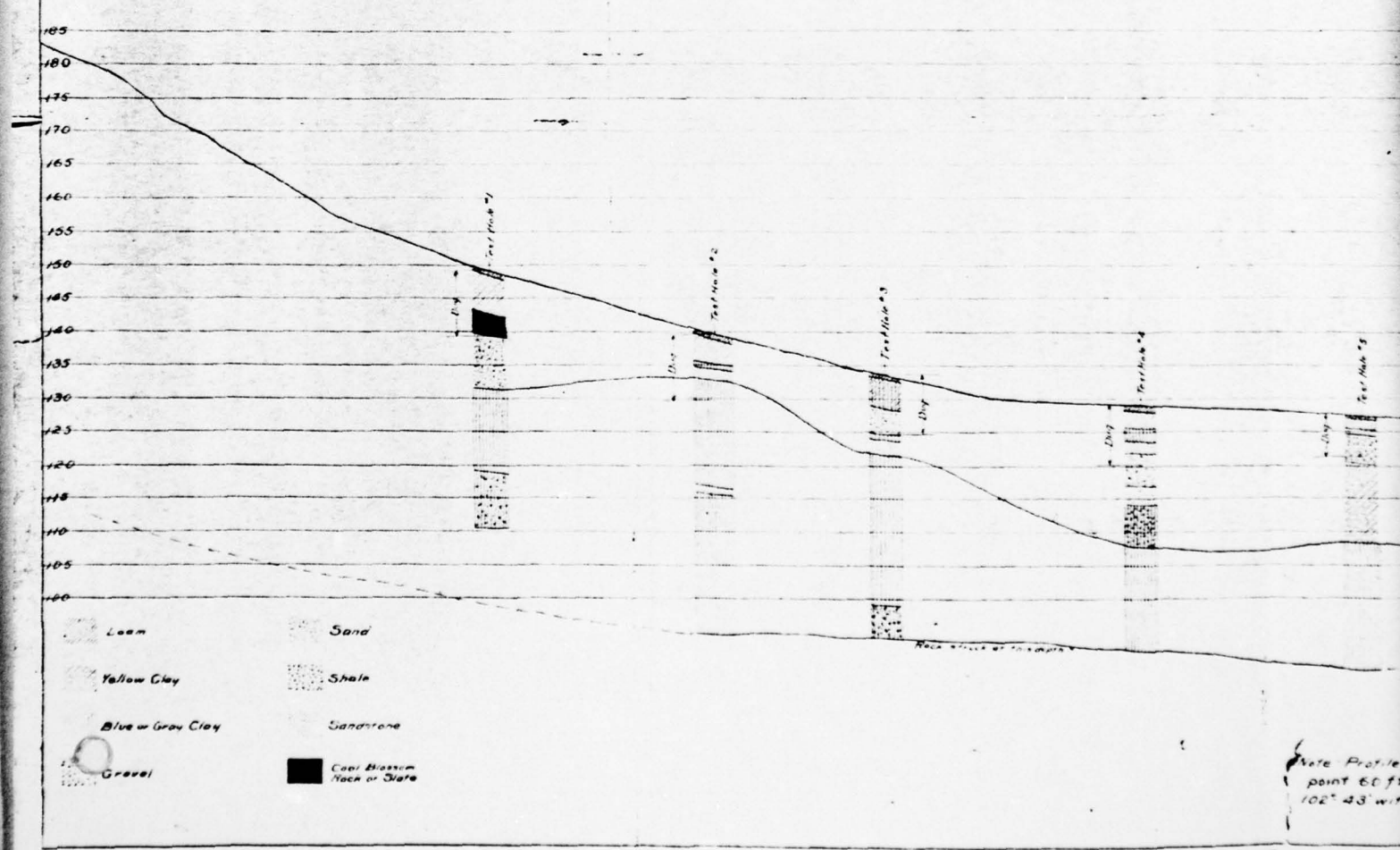
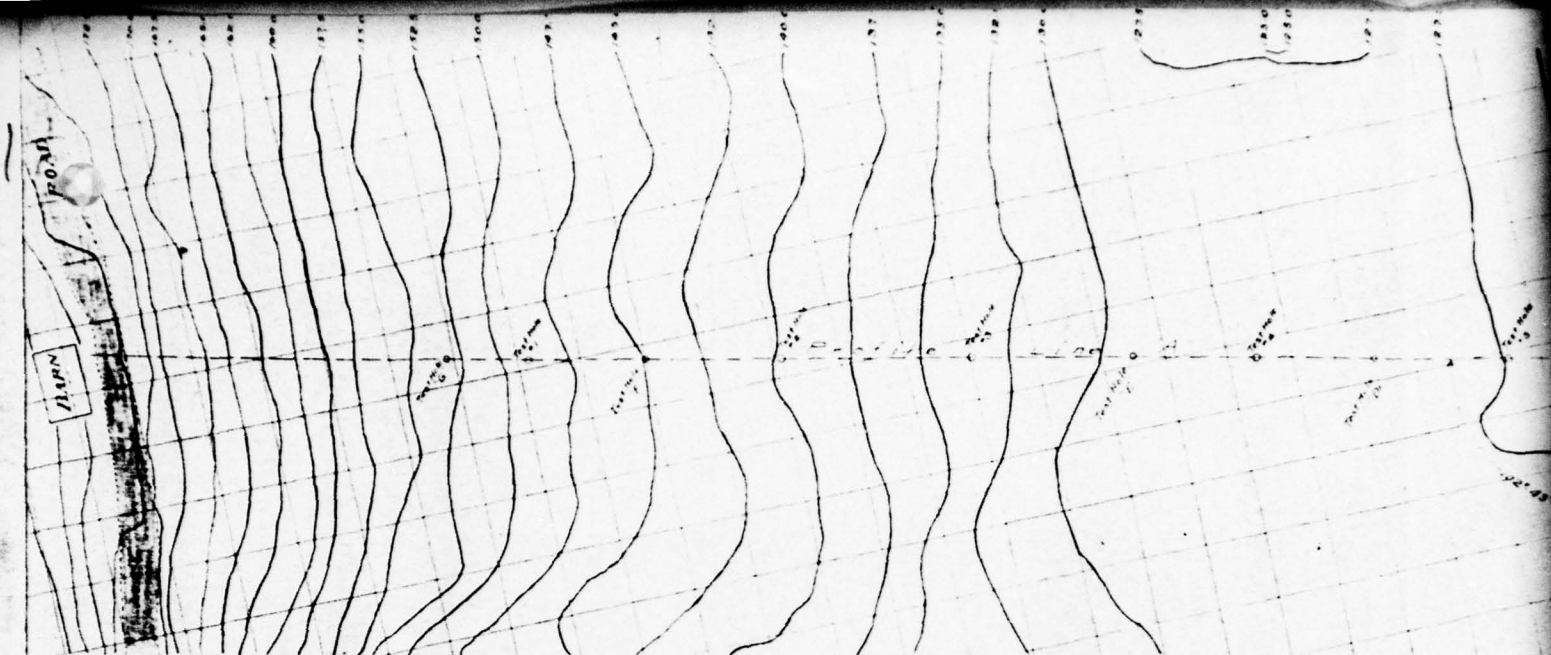
FIGURE 6

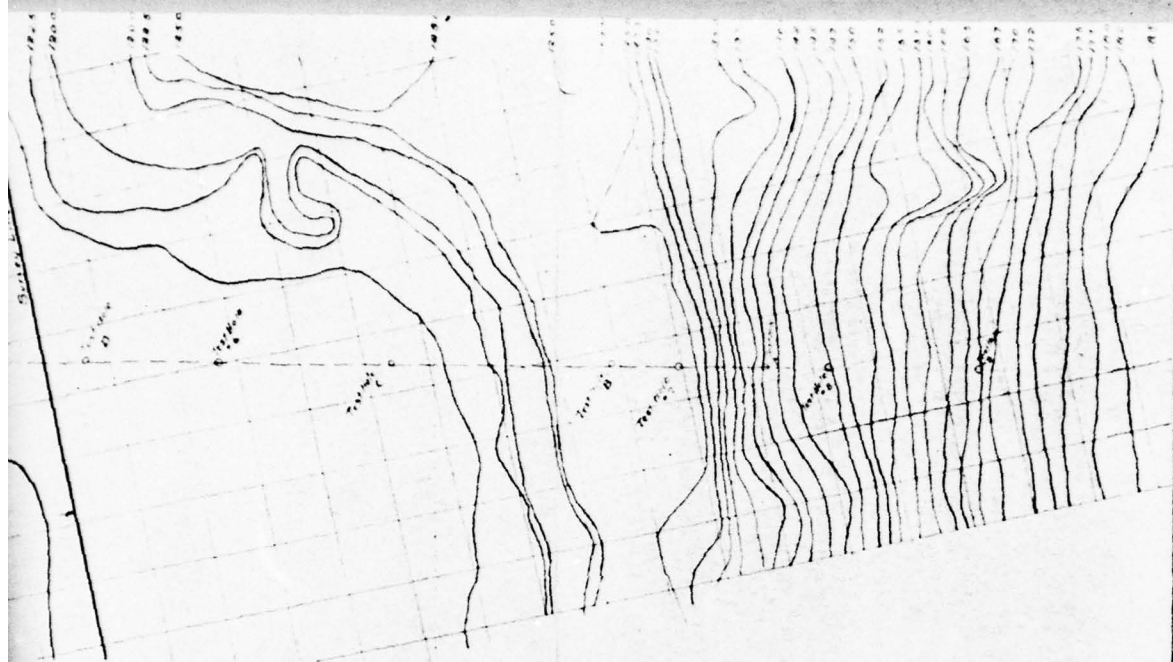
FILMED
MAR 1960



REVISIONS
By B. H. R. 10-10-68 HJF 8-5-68 HJL

<p align="center">LAKE ONEIDA DAM REPAIRS TO SPILLWAY PLANS SECTIONS & DETAILS</p>	
<p align="center">BUTLER WATER COMPANY BUTLER, PA</p>	
<p align="center">AMERICAN WATER WORKS SERVICE COMPANY, INC. <small>THREE PENN CENTER PLAZA PHILADELPHIA, PA. 19102</small></p>	
<p>SCALE AS NOTED DRAWN BY J.M.M. APPROVED H.J.C.</p>	<p>DATE 6-12-68 PROJECT CHECKED BY <i>DBE</i> INSP. BY <i>DBA</i></p>
<p>USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES</p>	<p align="center">3-532</p>





BUTLER, PA. **FIGURE 7**
 CONTOUR AND CROSS SECTION
 OF
 LAKE ONEIDA DAM

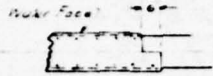
crosses BaseLine of Survey at a
 of Sta 95+00, making an angle of
 Line

Scale: Hor. 1" = 30' Vert. 1" = 5'

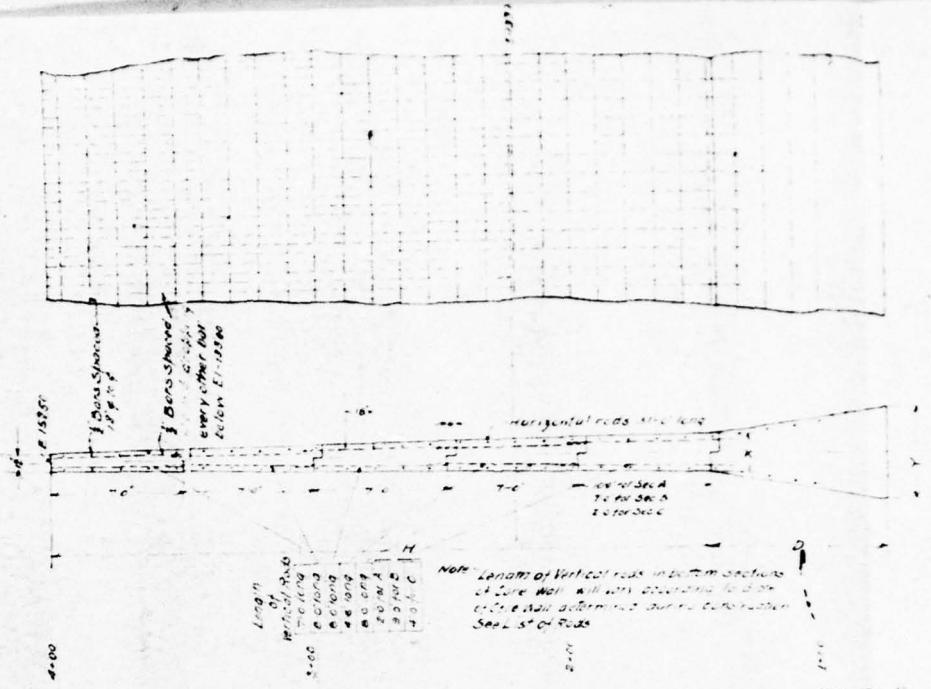
June 14 1910

Drawn by JMC
 Checked by

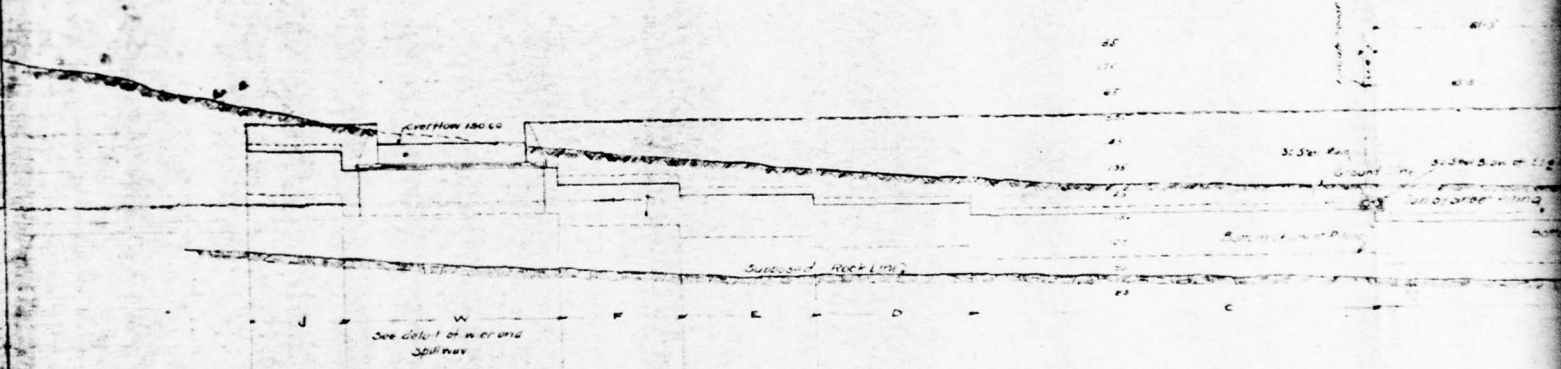
30034



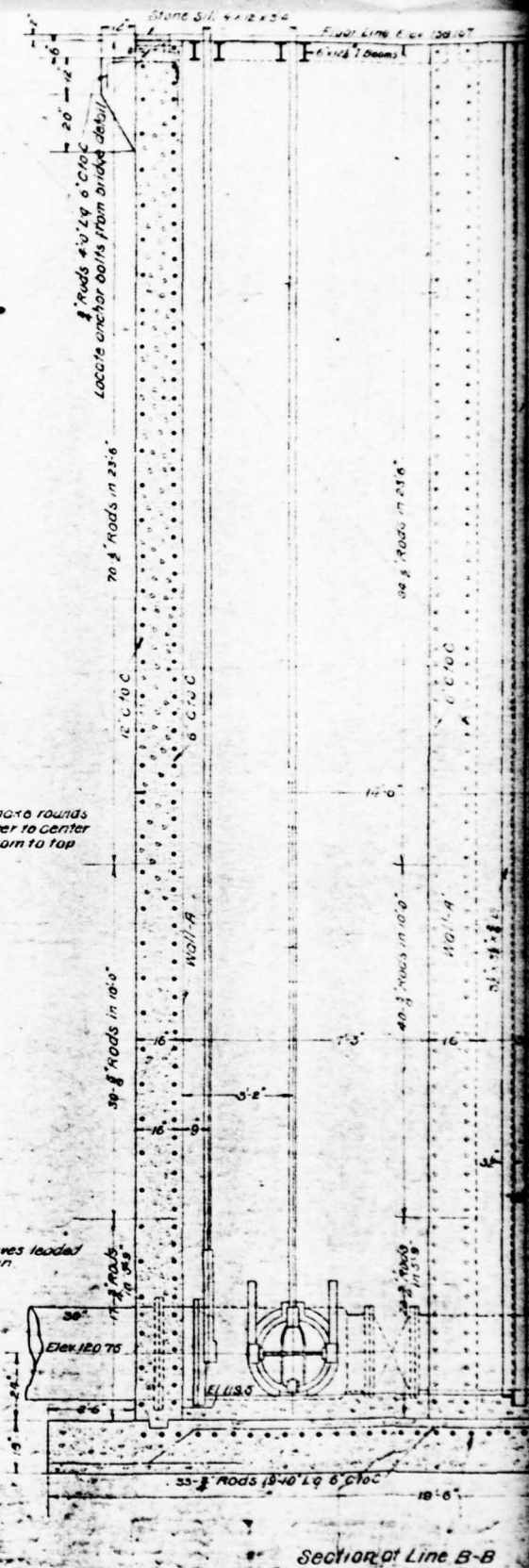
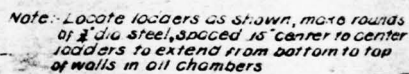
At joints to be made like this. Allow shot to extend 2" into next section

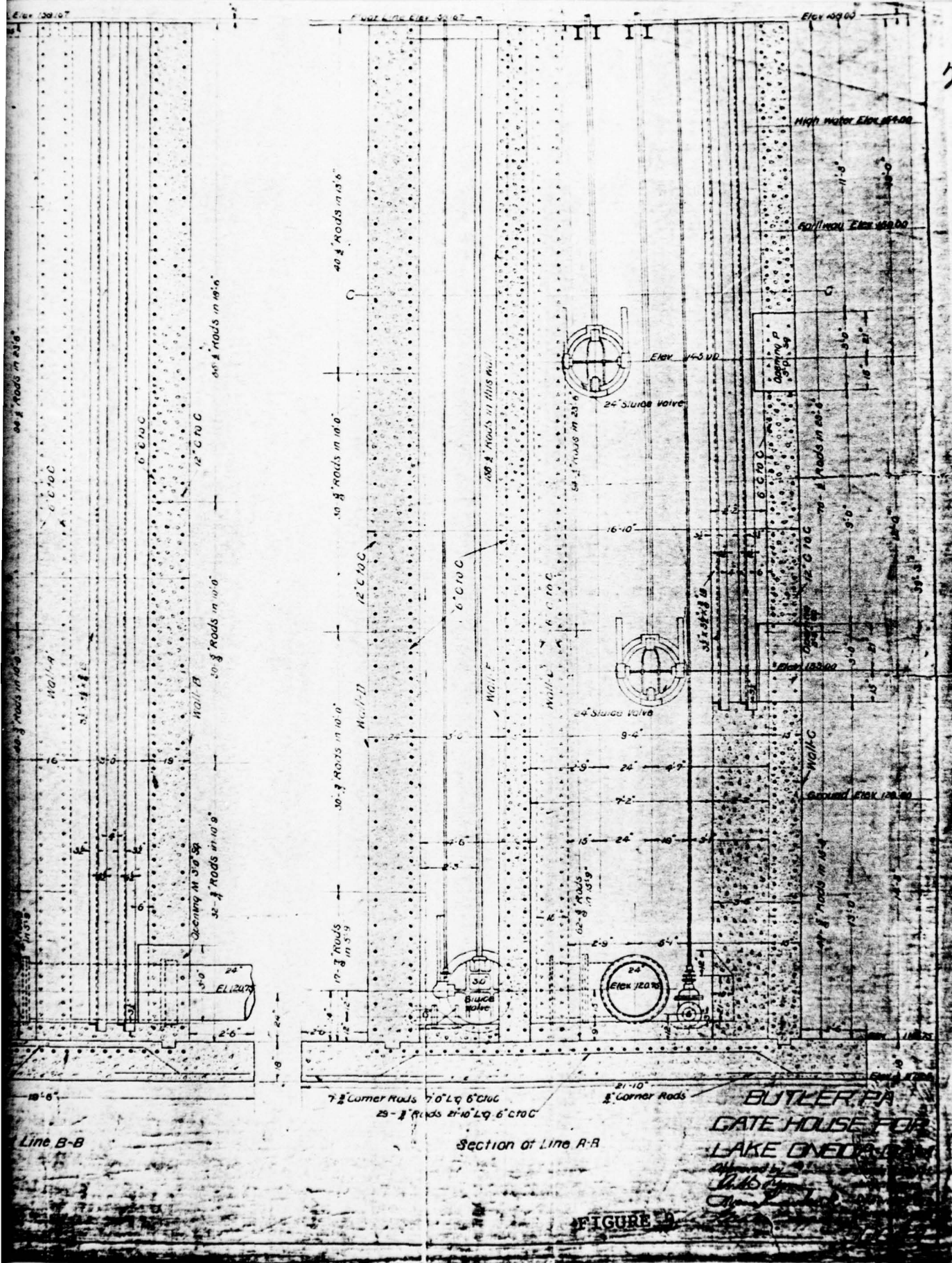


SECTION TRANSVERSE



Note: Depth to which core wall is carried to be determined during construction





APPENDIX G
REGIONAL VICINITY MAP

MOUNT CHESTNUT, PA.

N4052.5—W7952.5/7.5

1964
PHOTOREVISED 1972
AMS 5065 IV NW—SERIES V831

EAST BUTLER, PA.

N4052.5—W7945/7.5

1964
PHOTOREVISED 1972
AMS 5065 IV NE—SERIES V831

LAKE ONEIDA DAM

